Vol. 91, *No.* 3 New York, January 21, 1928 *Pages* 133-184

L. W. W. Morrow, Managing Editor
Earl Whitehorne, Commercial Editor
Allen M. Perry, Associate Editor
G. F. Witting, Statistical Editor
H. M. Cameron, Financial Editor
F. C. Wells, News Editor
Eustace C. Soares, Manufacturing and Markets Editor

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

W. H. Onken, Jr., *Editor*

Frank R. Innes and T. P. Kindig, Western Editors, 7 South Dearborn St., Chicago
H. S. Knowlton, New England Editor, 88 Tremont St., Boston
Walter C. Heston, Pacific Coast Editor, 883 Mission St., San Francisco
E. R. Searles, Assistant Editor
Paul Wooton, Washington Correspondent, National Press Bldg., Washington

Contents of This Issue

Editorials 133

Frontispiece—Correct Illumination Vital to Industry 136

High-Voltage Cable Problems 137
By T. N. Riley
Heating and cooling stresses must be considered as well as electric stresses. Loss tests should be based on load cycles. Further data obtained regarding ionization phenomena.

Costly Alterations Avoided by Use of Fan Ventilation 141
By M. D. Smith

Substation Motor Inspections 142
By O. M. Ward

Short-Circuit Ratio Is Significant 142
By L. A. Doggett

Utility Research Indicates Appliance Load Values. 143
By H. A. Snow
Tests show electric ranges, refrigerators and oil burners of great potential importance in raising average annual consumption. Residence service can be made high load factor business.

Conduit Costs Reduced With Threadless Fittings.. 148
By W. H. Backer

Intelligent Analysis vs. Expedients to Avoid Trouble 148
By G. B. McCabe

"Caveat Emptor" Policy Suicidal if Applied to Investor 149
By J. W. Stedman
Some tendencies on the part of investment bankers and utilities show disregard of the rights of the ultimate provider of necessary capital.

Water Heating—Good Business or Bad Business?... 152
By L. A. Hutton

Improved Electrical Service in a Modern Shoe Factory 153
By K. D. Hamilton
Plant of the George E. Keith Company illustrates latest practice in light, heat and power applications. Flexibility of operation assured by distribution system layout.

Industry Active in 1928 159

Letters from Our Readers 160

News of the Industry 163

Court Decisions, Commission Rulings 170
News About Men of the Industry 171
Financial and Statistical 173
Business News and Market Conditions 177
New Equipment Available 181
Electrical Patents 182

Business Facts for Electrical Men 183

We Thank You

"I AM really a jackass for not having renewed my subscription to Electrical World. There is more good stuff in it than in any other technical paper published. I can get more meat on important electrical matters out of four or five lines in Electrical World than from all the other trade magazines put together."

These remarks were made by an engineer who called at one of the Electrical World editorial offices to look up an article that had been published after his subscription had expired.

Now, Electrical World does not call its subscribers hard names when they permit their subscriptions to lapse, and it is too modest to believe that it can so efficiently condense news and technical information as the above statement would indicate. But it does believe that the electrical man who allows his subscription to go unrenewed is the greatest loser. The time of this engineer, spent in locating the article he required, was worth several times the cost of the year's subscription, and he probably missed other matters of equal importance.

Such spontaneous and unsolicited appraisals of Electrical World's value are most gratifying as a measure of the paper's service to its readers.

McGRAW-HILL PUBLISHING COMPANY, INC.
Tenth Ave. at 36th St., NEW YORK, N. Y.

James H. McGraw, President
James H. McGraw, Jr., V.-Pres. and Treas.
Malcolm Muir, Vice-President
Edward J Mehren, Vice-President
Mason Britton, Vice-President
Edgar Kobak, Vice-President
C. H. Thompson, Secretary

New York Dist. Office, 285 Madison Ave.
Washington, National Press Bldg.
Chicago, 7 South Dearborn St.
Philadelphia, 1600 Arch St.
Cleveland, Guardian Building
St. Louis, Bell Telephone Building
San Francisco, 883 Mission Street
London, 6 Bouverie Street, London, E. C. 4

Cable Address "Machinist, N. Y."

The annual subscription rate is $5 in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Haiti and Paraguay. Extra foreign postage, $4 (total $9 or 38 shillings). Subscriptions may be sent to the New York office or to the London office. Single copies, postage prepaid to any part of the world, 25 cents.

Change of Address — When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before the change takes place.

Publishers of
Engineering News-Record, American Machinist, Power, Chemical and Metallurgical Engineering, Coal Age, Engineering and Mining Journal, Electrical Merchandising, Ingeniería Internacional, Electric Railway Journal, Bus Transportation, Construction Methods, Electrical World, Radio Retailing, Electrical West (*Published in San Francisco*), American Machinist—European Edition (*Published in London*)

Copyright 1928 By McGraw-Hill Publishing Company, Inc.

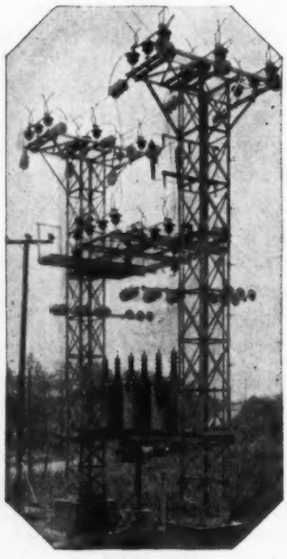
Published weekly
Entered as second-class matter Jan. 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.
Circulation of this issue, 19,325

Member Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Advertising Index—Alphabetical, 94; Classified, 88, 90, 92; Directory of Engineers, 48, 49; Searchlight Section, 50-54

On the 15th of every month you can have this wide-awake magazine without charge if you ask us today.

Are you acquainted with this organization if not we both lose



A standardized unit type station you will like

TRADE MARK DELTA STAR ELECTRIC CO. CHICAGO REG. U.S. PAT. OFFICE

Since 1908 this trade mark has been known as a symbol of quality and an emblem of service

Experience.... Who Has It?

ONE of the first things you ought to know about a manufacturer with whom you are considering doing business, is his experience. Just as the first thing you want to know about a man you are contemplating as manager is to know what sort of background he may have had—how much actual experience in your line of work.

YOU are after results when you select a manager for your property and equally so you are after results when you select a manufacturer of equipment for use on your transmission system.

AFTER you have questioned different manufacturers, as to what they can offer you in experience, equipment and service, ask this question of each one.

"NEXT to your own company what company in this country do you consider best fitted to build the equipment I need?" You probably will find that most of them will agree on one company—DELTA-STAR.

THE reason we suggest this procedure is that if you have not had business dealings with us and know from actual experience what we can offer—then our competitors will know more about us than you do.

NATURALLY they are human and being human may be influenced by jealousy or other human short comings. For that reason, after "polling the vote" and giving it proper weight—then come to Chicago and determine for yourself.

IN THE high tension field, DELTA-STAR is an old experienced institution, but young in spirit and the determination to keep several jumps ahead of the field.

We would like to have you visit our factory, meet our engineers, witness tests in our 750,000 volt laboratory and see for yourself our modern methods of manufacture.

A. W. Young

President

DELTA-STAR ELECTRIC COMPANY
2400 Block, Fulton St., Chicago, Illinois

Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 91 — *New York, Saturday, January 21, 1928* — NUMBER 3

An Unsatisfactory Official Summary

IT IS difficult to come to any definite conclusion from the meager summary of the Federal Trade Commission's report on "the supply of electrical equipment and competitive conditions," at least so far as the electric power industry is concerned, and it is equally hard to escape the thought that perhaps there was a reason for bringing out the summary at this particular time. Viewed in the abstract, the presentation appears reasonable in spots, while in other places it is open to serious questioning and doubt. What is said of holding companies may be true of some of them, but certainly not of all of them. That they are not subject to regulation is, of course, well known, as is also the fact that rates for service of underlying companies are based in many states "on the capital honestly and prudently invested." Inasmuch as the Federal Trade Commission held hearings and supposedly delved for facts, a statement to the effect that certain things are alleged about speculative fluctuations in prices ought to have been substantiated. Whether the commission is just to the holding company or not can be revealed only by reference to the complete report. Until that is printed and available, therefore, judgment must be held in abeyance.

* * * *

State Commissions Roused to Defend Themselves

SENATOR WALSH of Montana, in arguing his case against public utility companies, holding companies and management corporations before the Senate committee on interstate commerce in Washington this week, was certainly not at his best, for if he then and there unbosomed himself of all he had in mind, the case against the utilities is not very strong. Although very little that is tangible was presented, it is nevertheless generally conceded that some sort of investigation will be recommended. What the extent and scope of it will be will soon be determined after all sides have been heard. That it will be thorough and economic in scope is perhaps too much to expect, but that it will be only mildly sensational has already been demonstrated. The investigation, it must be remembered, will start as an inquisition from above and not because of mutterings of discontent from the users of the service. Hence it will in all likelihood be lacking in popular appeal.

The attempt to prove that the ultimate consumer is unprotected from extortion because, as Senator Walsh contends, state public service commissions are not functioning effectively will probably be the rock on which any political investigation will founder. Although the commissions as a body were at first somewhat backward in their own defense, they discovered in Senator Bruce of Maryland a valiant champion. He was quick to disagree with Senator Walsh and contended not only for the integrity and probity of the commission of his own state, but also espoused the cause of untrammeled state regulation of intrastate utility service. The commissioners when they subsequently had opportunity to speak for themselves proved worthy of Senator Bruce's defense and made their own position perfectly clear. Thus it would appear that if Congress sticks to its last it will limit the Walsh investigation of utility companies to interstate commerce, and inasmuch as electricity and gas are for the major part consumed in the state where they are manufactured, any committee will have to watch its steps closely if it is not to encroach on the rights of the several states.

* * * *

The New Phase in Co-operation

FOR years electrical men have been talking about co-operation—as a theory and a principle. In fact, there has been so much talk that we are almost weary of the word. It would seem, however, that as a policy and a practice we are only now beginning to find the meaning of it all in any broad industry sense. This was the lingering impression that one brought away last week from the dinner to W. W. Freeman, when he received the medal for co-operation given under the James H. McGraw Award in recognition of his achievement in reorganizing the directorate of the Society for Electrical Development to represent officially the four major national associations and the leagues.

Owen D. Young crystallized the point in characteristic fashion when he said in his address: "Men work as individuals when they can. They co-operate when they must." And there one has the reason why in this electrical industry co-operation is right now apparently passing from its talking phase into a more purposeful phase of practical application. It is an intriguing thought. As Mr. Young pointed out, no man desires to co-operate until he is compelled to accomplish ends beyond his grasp as an individual. As far as he can he goes ahead alone. Then comes a time when to attain his aim he must have the help of others whom he cannot individually control. There is only one way in which he can influence them, and that is by the give-and-take process involved in co-operation.

The electrical industry has been following this very course. The onrushing growth of the popular demand for electric service of all kinds has brought great prosperity and opportunity. Power companies, manufacturers, jobbers, contractors and dealers have been able to go forward with their own plans in their own way. The co-operation that has been developed within the industry has been more social and fraternal than practical. But now comes a new era. The electrical industry at last begins to realize that it has a selling job to do and that in the great marketplace all electrical men must work

together if they are to prevail against the strength of other industries. And so we see this reorganization of the S.E.D. and the convening of an industry sales conference, and a distinguished gathering pays tribute to the man who makes it possible. Co-operation is getting to its work.

* * * *

Communication by Sight and Sound

RESEARCH work in communication has annihilated space and time. It is now possible to hear and see simultaneously independently of distance, and this laboratory accomplishment will become a commercial reality in a short time. The demonstration of home television by Doctor Alexanderson has followed as a logical step the spectacular television demonstrations of last year. It is true that the commercial application of laboratory results must await the solution of many technical and economic problems, but past experience proves that these problems will be solved.

The art of communication is developing very rapidly because of the advent of the vacuum tube and of other facilities introduced by radio inventors. New methods and better methods of communication may be expected, and yet the fundamental aspects of present services will remain. There need be no fear that the telephone and the telegraph will be relegated to the scrap pile, for they are essential. New equipments and new methods will be incorporated with these fundamental devices to give better service. Vision added to sound will make possible communication of a quality undreamed of in present commercial installations. The day approaches when people in any part of the world may see and hear people in any other part of the world. May not this in time result in the stabilization of world affairs and the creation of worldwide understanding?

* * * *

The American Engineering Council and Electrical Engineers

ORGANIZED in 1920 for the purpose of making engineers articulate in public affairs, the American Engineering Council has not been so effective as it might be did it receive heartier and more devoted support. It has been handicapped, for example, by the refusal of the civil engineers to join with the other national bodies in making the council the point of contact between engineers and the federal government, thereby enabling the latter to obtain very much needed advice and factual information from disinterested rather than from interested sources, reliable as the latter have proved themselves to be. And yet, despite handicaps, the American Engineering Council has managed to build up an excellent reputation for performance and achievement. Its studies and reports on the elimination of waste in industry were noteworthy accomplishments, as were also the reports on Muscle Shoals, coal storage and the productivity of labor.

Most of our social and political problems are now economic in nature, and on such issues the engineer, with his bent for investigation and his analytical mind, is most competent to instruct and advise. That he has not done so more effectively or played a more telling part in political life is a reflection on himself and his profession. Certainly, opportunities innumerable abound, and government needs enlightened guidance. The cost of the Council is not very great, less than $50,000 a year, and that is spread over numerous national and local engineering bodies which compose the membership. More could be done if greater funds were available, but what the American Engineering Council covets first of all is the active interest of engineers everywhere in its work, together with their suggestions. Thus aided and encouraged, the work itself is sure to command financial support.

An electrical engineer has just been elected president of the Council, and while this fact does not take one ounce of responsibility from the shoulders of the other engineering professions, it is a challenge to the electrical engineers of the nation to uphold the faith the public has in their almost matchless and magical capabilities.

* * * *

The Demands of Tomorrow

THE mutuality of interest between equipment manufacturers and electric light and power companies and the co-operation in research, design and development that has been evidenced as a result of this interest are the best assurance of continued progressiveness on the part of both groups. The advance that has been made is so amazing as to appear consummately successful, yet, at the same time, all the boasted efficiency and perfection of design is pitifully inadequate. Today's merits are tomorrow's shortcomings.

To look through the shadows of the future to the accomplishments of a new present is often, because of the variable and unknown factors of the physical, economic and social elements, a task impossible of accurate performance. Certain things may be taken for granted, however, with but little likelihood of ultimate discredit. It is the co-operative effort of manufacturers and utility men that will lead to the several solutions.

The unconscionable waste that carries 50 per cent of the heat in the steam into the discharge canal will be reduced to a major degree. The expenditure necessary to provide protection for equipment of all kinds against the weather through the provision of sheltering structures will be reduced. The devices for interrupting circuits will offer far better service, design and maintenance features than today's best accomplishments for achieving that purpose. The use of pole lines and open wire construction in city and suburban districts will become obsolete, and their discardment will take place without incurring the costs and complexities involved in present underground practice. The crudely laborious methods of testing meters will yield to machine-like accuracy of calibration and increased speed of adjustment. Motor characteristics will be varied to permit system power factors approaching unity with minimized deviation. Industrial plants, offices, homes and highways will be illuminated, not spot-lighted. The cost of the equipment necessary to provide service to an industrial customer will be curtailed by improved design and reduced requirements for apparatus.

The business of providing electricity for light, heat and power is only just entering the stage of simplification which follows the preceding eras of invention and development in the history of every engineering application. In general, there will be lessened complexity in types, quantity, size and installational requisites. Maintenance and supervision will be minimized in all apparatus characteristics. Costs will be reduced. It is as futile to discount the ultimately necessary thing as it is to deny today's inadequacies.

Industry Sales Conference Charts Its Course

AFTER two months in which its six functional committees have been at work, the Industry Sales Conference held its second meeting last week to chart the course it is to follow in developing a sales program for the electrical industry. The first meeting merely analyzed the market problem and decided that a broad sales plan should be set up looking first to the development of the great market in the residence field now largely blocked by the inadequacy of house wiring. The reports of these committees are not yet released for publication in detail, for they have been referred to the executive committee of the conference for co-ordination and budgeting, but their general tenor has been announced. The conference will recommend immediate action in two directions:

First, a national movement of locally organized selling campaigns to merchandise the idea of adequacy in house wiring and to sell outlets and equipment for use in them, power companies to be responsible for local leadership, with the co-operation of leagues.

Second, a broad educational work among all contractors to promote better standards of estimating, cost keeping and business methods, that house wiring may be raised to a higher plane of competition for adequacy and completeness of equipment rather than by price paring.

The fact that these committees as well as the full conference itself are representative of the four major groups of the industry makes the work of this body of particular interest and portent. For the first time the entire industry is engaged in a commercial planning job. An embracive program is in the making that will present not only an opportunity, but a purpose, a plan, a proposed organization to do the work and a budget of expense, all carefully co-ordinated with the activities of other industry agencies. This sales program will be before the industry this summer and will undoubtedly receive searching analysis and criticism at the conventions. If the plan is good, this fall may see the start of a progressive market-building enterprise on a scale that will be new to electrical men. And present indications seem to justify the hope.

* * * *

No Further Need for Doubt

MILLIONS of domestic users already connected to the power companies' lines represent, in the aggregate, one of the principal fields for future load and revenue. Very definite data taken from experience are presented in this issue of the ELECTRICAL WORLD by Harry A. Snow, who shows that there is no difficulty in greatly raising the national average above the present paltry one kilowatt-hour per day. He points the way to practical domestic load building with three of the major household appliances—the electric range, electric refrigerator and motor-operated oil-burning furnace. The data and conclusions drawn are based on a series of tests on typical installations in Detroit homes. Taking the average annual consumption of 540 kw.-hr. per residence customer in Detroit, the individual and collective effects of adding the electric range, refrigerator and oil-burner loads are shown. The results bring into sharp relief the conclusive evidence that residence consumption can be increased 50 to 500 per cent by the use of one or all of these devices.

Furthermore, the analysis of load characteristics shows that the use of these three appliances does *not* put excessive demands upon the power system, unduly increase the system peak or entail heavy investment in additional capacity. Quite the contrary is shown in fact. In the specific case of the electric range less than half the class demand of one thousand ranges comes on the system peak. The electric refrigerator has a most desirable yearly load curve, and the oil burner shows decidedly off-peak characteristics in its operations. The combined loads of these three appliances puts an entirely different complexion upon the domestic use of energy. Consumption per customer is increased from 540 kw.-hr. to 2,820 kw.-hr. per year, while the maximum demand per customer is only 913 watts and as a class the domestic user is operating at a 35 per cent load factor.

When it is considered that, as a group, a thousand domestic customers, each equipped with a range, a refrigerator and an oil burner, in addition to lighting and miscellaneous uses, have a maximum demand of only 913 kw. and will consume 2,820,000 kw.-hr. annually, the residence load becomes indeed attractive.

* * * *

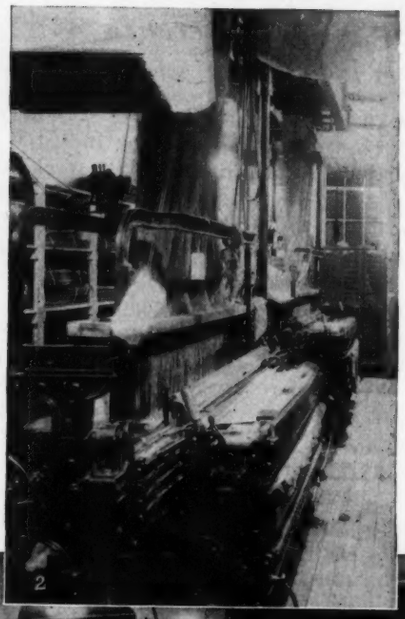
The Manufacturer in the Federal Trade Commission Report

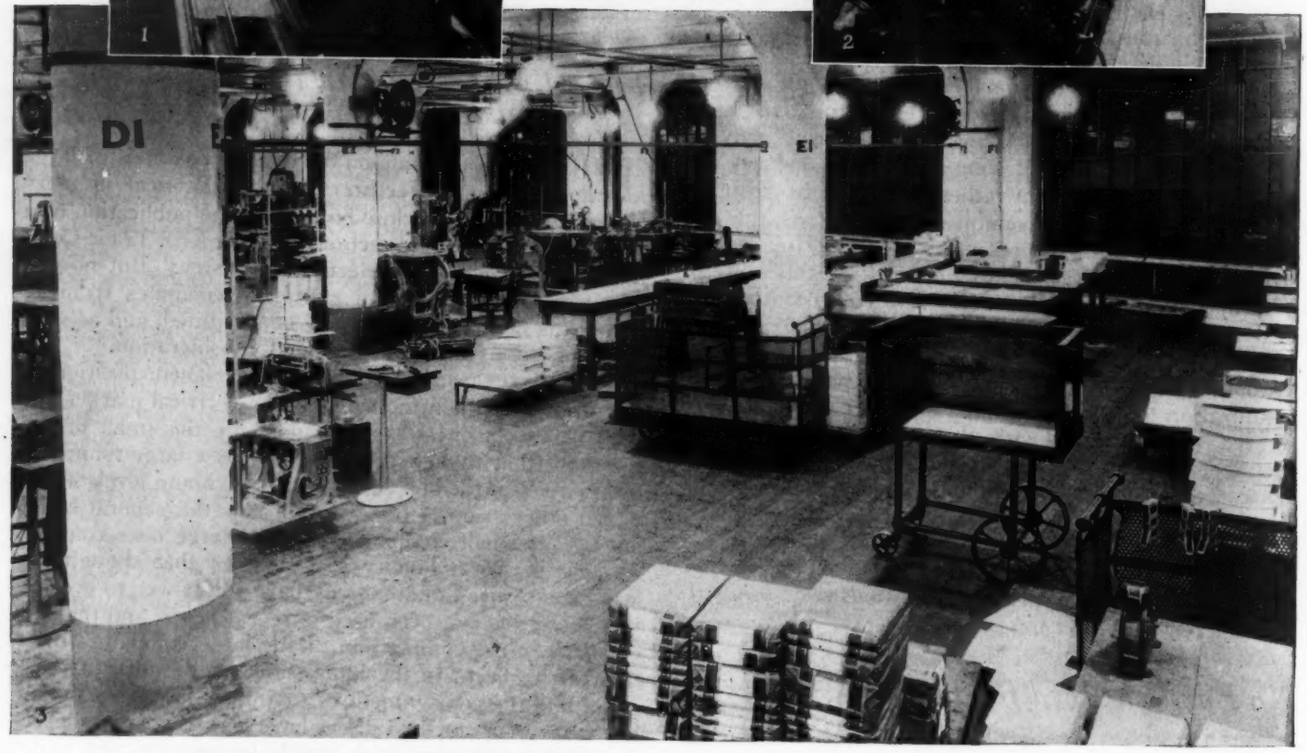
THE perennial debate on the relative positions of large and small manufacturers in the electrical industry will hardly come to a close because of the publication of a summary of the second section of the Federal Trade Commission's report on the electrical industry. But no one can deny that the opinion expressed emanates from an inquiry as neutral as could well be instituted, and as such the conclusions merit fair-minded consideration.

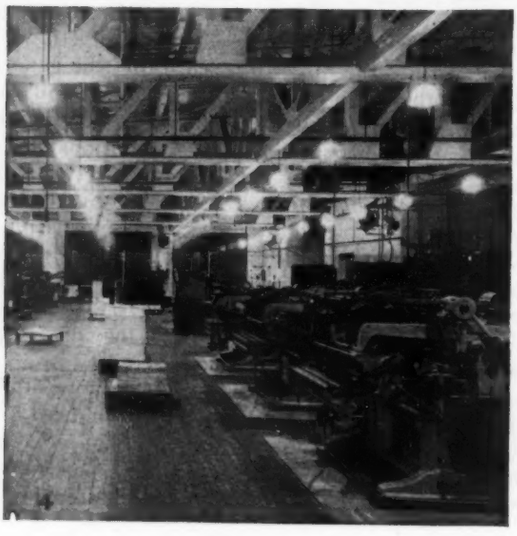
The report says that despite the permanent position of the three large manufacturers in the electrical market, the bulk of the business is being done by the small manufacturer; that though the prices of these large manufacturers are regarded by the trade as maximum levels above which others cannot hope to sell, it is the general belief among the small companies that the large ones compete actively in price, quality and service; that though the large companies "undoubtedly have the power to crush," this power has not been used in recent years, and that the elements in the competition of the large companies most difficult to meet are the lump-sum bid, the quantity discount and the consignment of motors. In the fractional-horsepower-motor field prices have been reduced to levels at which many have been unable to compete, but many state that "other small companies rather than the very large ones are their sharpest price competitors." The report justifies the direct inference that the general price policy of the large manufacturers is fair and that they have brought a stabilizing influence to the market. It makes particular point of the contributions to progress that have been made by the General Electric and Westinghouse companies through research. In conclusion the commission pays a tribute to the trade associations of the electrical manufacturers for the influence they have exercised in keeping the activities of the industry in line with the anti-trust law.

This kind of a pronouncement by this responsible governmental authority cannot be accepted as a complete answer to all questions as to the economic position of the small and large manufacturers in our industry. But it serves as a very definite brake upon the complaints of men who place upon the large companies too much blame for their own lack of success in the competitive market.

Correct Illumination Vital to Industry







PROPER lighting is as essential to industrial customers as the adequate utilization of electric power. Production may be increased, material spoilage reduced and employee morale sustained.

An increase of production of 370 per cent is claimed through the installation of properly designed fixtures in a hosiery mill. A belting manufacturer raised his output nearly 20 per cent by an expenditure which, when reduced to a payroll basis, represented a cost increase of but 1 per cent.

No. 1. An excellent example of uniform lighting effect in silk mill practice.

No. 2. The lighting of this jacquard loom is indicative of the practice which requires illumination in both horizontal and vertical planes.

No. 3. The illumination of the warehouse and pressroom of this printing establishment is one of the best examples of uniformly distributed lighting in New England.

No. 4. Pressroom illumination must be of correct intensity and incorporate glare-free characteristics if quality and speed are to be maintained.

High-Voltage Cable Problems

Heating and cooling stresses must be considered as well as electric stresses. Loss tests should be based on load cycles. Further data obtained regarding ionization phenomena

By T. N. RILEY
Cable Engineer, Standard Telephones & Cables, Ltd., London

IN TESTING materials subject to mechanical stress it has been well established for many years that a load that can safely be applied if steady may rapidly produce failure if variable, and many tests have been made to establish the safe stress for alternating loads of various kinds. In cable work, for example, a great amount of work has been done on lead sheathing to develop a type of sheath that will prove satisfactory in situations subject to vibration. In applying these principles to the cable dielectric, however, it is surprising that engineers have concentrated their efforts so greatly on one variable factor only and have relatively neglected a second and equally important one. They have, for example, studied almost exclusively the time for which a cable would operate without failure when subjected to alternating electrical stresses of different magnitudes and have neglected to take into account that under service conditions the applied current loading, and therefore the temperature, is also continuously varying. The results obtained under test conditions in which one factor only is varied may therefore be totally different from those obtained when the second factor is taken into account.

The heating and cooling of a cable in service may cause changes in the physical structure due to any one of the following causes: (1) Expansion of the compound leading to permanent distortion of the sheath in an initially well-impregnated cable. (2) Redistribution of the compound in the dielectric after expansion as in (1), particularly where the cable is laid on a slope. (3) Relative movement of the cores and filling or separation of the cores in a multi-core cable.

If the cable is to be satisfactory in service, its structure must be such that these changes cause little or no alteration in its electrical behavior, and the logical tests to apply are those that are most sensitive to such physical changes. Altogether undue emphasis has been placed on high-voltage tests, which are relatively insensitive to small physical changes and would reveal no definite deterioration except after such prolonged application of voltage and load as would be impracticable in a factory test. Moreover, to be effective, a pressure considerably in excess of the working pressure must be applied, so that the test no longer closely represents working conditions.

The dielectric loss test is much more sensitive to physical changes, and although such tests have been made, they have hitherto been directed rather to measuring the actual value of the losses under specified pressures or at specified temperatures than to measuring the variation of the losses produced by physical changes in the cable. In this respect current practice has reversed the real order of importance of the tests. It is admittedly desirable that the power factor should not be too high, but it is still more important that it should not increase in service when the cable is subjected to variations of load. In spite of this it is the exception in cable specifications to find any provision made for testing the power factor after one or more cyclic changes of load such as the cable must experience in service.

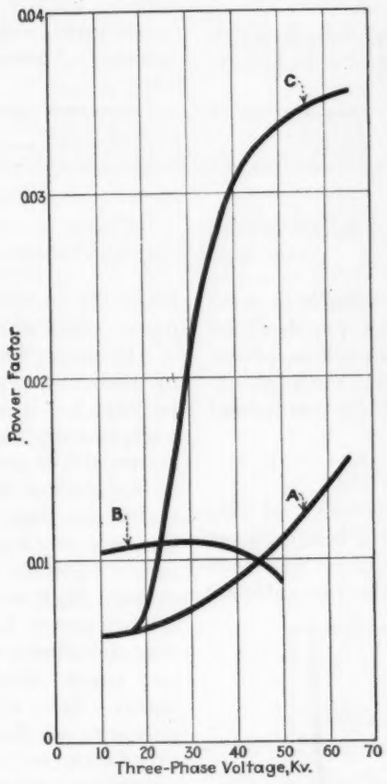


FIG. 1—BEHAVIOR OF A 33,000-VOLT CABLE OF THE BELTED TYPE DURING DIELECTRIC LOSS TESTS

Curve *A* shows the variation when first manufactured. Curve *B* shows results when the cable is heated to 70 deg. C. Curve *C* shows the power factor when tested after heating.

The behavior of a 33,000-volt cable of the ordinary belted type during such a test as is advocated is illustrated in Fig. 1. Curve *A* shows the variation of power factor with voltage when first manufactured. It will be noticed that up to double the working voltage the power factor does not exceed 0.015, so that the cable would pass any normal specification. A similar test taken when heated to 70 deg. C. (Curve *B*) shows a power factor below 0.011 up to 50 per cent over the rated voltage. This is again a satisfactory test, and as dielectric loss tests are usually carried no further, the cable would normally be passed into service.

If, however, the test is repeated on cooling after the heat run, Curve *C* is obtained showing a very marked increase in power factor over the initial value from the working pressure upward. Even then the power factor as an absolute value is not excessive, but the marked increase of loss after the heat run indicates that some change has taken place in the cable structure due to the load.

If this increase of loss is localized, it may represent appreciable damage to the cable at every period of cool-

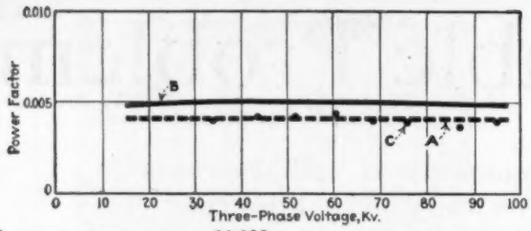


FIG. 2—TEST RESULTS ON A 33,000-VOLT H-TYPE CABLE WHICH HAS A STABLE CHARACTERISTIC

Curve *A* is immediately after manufacture. Curve *B* is the test when heated on load. Points on *C* are taken when the cable is cooled after heating.

ing on light load—damage that will be cumulative and will eventually lead to breakdown. It is known, for example, that most breakdowns of high-voltage cable for reasons other than mechanical faults have occurred during light-load periods.

The cable the test results of which are given in Fig. 1 would pass all normal tests in the factory, but would be unsatisfactory in service unless its normal load were so light as never to raise its temperature appreciably and in consequence never to cause the harmful physical changes. This would, of course, be an uneconomical condition of operation.

The test results on a cable for the same voltage which has a stable characteristic is shown in Fig. 2. As before, *A* is the test immediately after manufacture, and *B* is the test when heated on load. On cooling, again the values of power factor obtained at each voltage are practically identical with those obtained in the initial test—that is, are nearly constant at all voltages.

This indicates two things that are of importance in ensuring freedom from trouble in service: first, that the dielectric loss remains low both on load and on cooling without any progressive increases, and second, that there is no ionization and therefore no burning of the papers or oxidation of the compound to be feared in service.

Type of Cable Effects Results

What type of cable will give characteristics of this order? In the first place, the flatness of the initial power factor voltage curve is typical of an insulation in which all stresses are radial—that is, of a single-core cable or the equivalent three-core cable in which each core has a metallized surface. If tangential stresses exist, the surface leakance current tends to increase more rapidly than the capacity current as the voltage rises and to cause an increase of power factor, which gives the power factor voltage characteristic a curve upward, even when there is no ionization. This is evident in the belted type of three-core cable, but is also indicated to a smaller extent in three-core cables having an equipotential sheath if that sheath is not continuous but is formed by spaced tapes. In this case the current paths from the edges of these tapes are tangential to the laminated insulation and the power factor is raised. This is illustrated in Fig. 3, where the spacing is exaggerated for clearness. The consequent rise of power factor is more marked at the lower frequencies, where the capacity current is smaller.

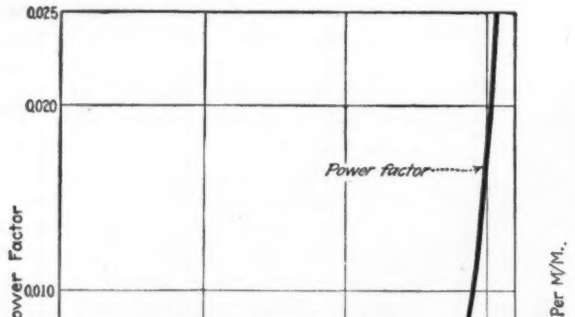


FIG. 3—POWER FACTOR-VOLTAGE CHARACTERISTICS OF UNIMPREGNATED CABLE WITH AN EQUIPOTENTIAL SHEATH

The dielectric must be free from all voids or air spaces—that is, it must be fully impregnated. If voids exist, then as soon as a certain stress is reached there will be an internal discharge across them, leading to a rapid increase in power factor. For cables up to 11,000 volts working pressure having the insulation thicknesses usual in English and American practice this ionization pressure is usually above the working pressure and even imperfectly impregnated cable will not give rise to trouble. Above this figure the higher working stresses necessary to keep dimensions reasonable render this immunity unattainable.

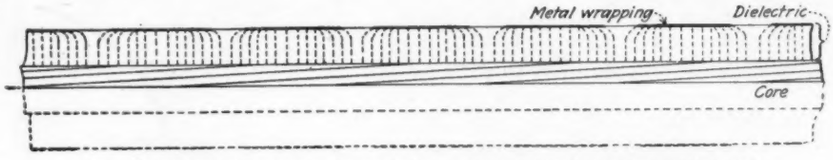


FIG. 4—DIAGRAM SHOWING EFFECT OF GAPS IN METALLIZED SHEATHING

The power factor voltage characteristic of a cable made up with dry paper having no compound at all is shown in Fig. 3. It will be noticed that the power factor is exceptionally low up to the point at which ionization starts, and it then increases very rapidly.

It is necessary to choose suitable paper and compound and to dry them thoroughly in order to make certain that the dielectric loss shall increase very little with temperature. Residual moisture has a very marked effect in causing high initial power factor together with a rapid rise of power factor with temperature. This can, however, be eliminated by careful drying of both compound and paper under vacuum before they are brought together. It is also important in this connection to avoid exposure of the dielectric to the atmosphere after impregnation and before lead covering. The choice of a suitable paper and compound is a rather more complicated question. Take first the paper. Apart from its electrical characteristics, it must, of course, have mechanical strength. At one time only manilla papers were satisfactory in this respect, but at the present day chemical wood-pulp papers can be obtained that are equally satisfactory in this respect. The basic fiber is therefore of only secondary importance, and from a cable-making point of view the vital considerations are its structure, affecting its oil-absorbing power and dielectric strength, and its chemical purity, affecting its intrinsic power factor after removal of moisture. On both these points a large amount of research has been carried out in the Standard Telephones & Cables laboratories. Fig. 5 shows power factor temperature characteristics on a

series of papers after subjection to equal drying. It will be noted that a large number have more or less similar characteristics, but of these only No. 18 is also suitable as regards absorption and dielectric strength.

It has been shown by Luigi Emanueli that the dielectric strength of paper is partly dependent on the air resistivity of the paper and that in general the dielectric strength increases with the air resistivity. This is true only so long as the higher air resistivity results from close packing of the fibers leading to a dense structure and not from extra beating of the pulp, which hydrolyzes the cellulose and gives a non-porous paper of the greaseproof type. The latter type of paper may have 25 per cent less dielectric strength than the former for the same air resistivity and thickness.

Effect of Insulating Oil

In selecting oils three factors have to be taken into consideration: (1) The power factor-temperature characteristic when new. (2) The change produced on prolonged heating or subjection to electrical stress. (3) The viscosity as affecting the movement of oil in the cable in service.

Comparative power factor-temperature characteristics of a series of oils as supplied by the refiners, except that all have been vacuum dried, are shown in Fig. 6. All these oils are mineral oils having a petroleum origin, but the difference in behavior is remarkable. There is also a considerable variation in the quality of two consignments of the same oil as is indicated by the two curves labeled No. 10. There is a considerable need for further research on the part of oil refiners into the methods required to give good electrical characteristics, as little accurate knowledge appears to exist on this point.

The rate of deterioration of the same oils after heating for different periods in air at 100 deg. C. is shown in Fig. 7. It is noteworthy that the relative position of some oils is reversed after long heating, hence a low initial test is no criterion of suitable quality. The oils are not, of course, heated in air in service, but those oils the structure of which is likely to change when heated in air are also most likely to change on exposure to heat and electrical stress in service. It is also noteworthy that the change produced is in general irreversible: whereas actual carbonized matter can be removed by filtration or centrifuging, that factor which causes high power factor cannot be so removed and the oil appears to be permanently deteriorated (see Fig. 8).

The viscosity of the oil is very closely associated with the type of cable structure to be employed in insuring that the power factor-temperature characteristic does not change on cooling after load. If the complication of a hollow-core cable with standpipes and oil reservoirs is considered justifiable for very high pressures, a low viscosity is desirable, but if the normal type of solid structure is employed, the viscosity should be as high as possible, provided always that the actual setting point at which any change of state occurs is below the temperature at which the cable will normally be handled in manufacture and laying.

Up to the present the question of how to get a satisfactory cable up to the point at which its manufacture is completed has been discussed. Next to be considered is how it will behave on load.

When the dielectric is heated, the compound must expand, and in expanding it will expand the lead sheath. The latter is plastic, and as the cable cools again it retains its shape while the compound contracts, so that small voids must be formed inside the sheath. If these voids are subject to electrical stress above a certain value, ionization will occur and the power factor will rise. The narrower the spaces across which the potential is applied the higher will be the stress required to set up ionization. Hence the change of power factor is greater in the ordinary type of three-core cable, where the stress may at certain instants be along the layers,

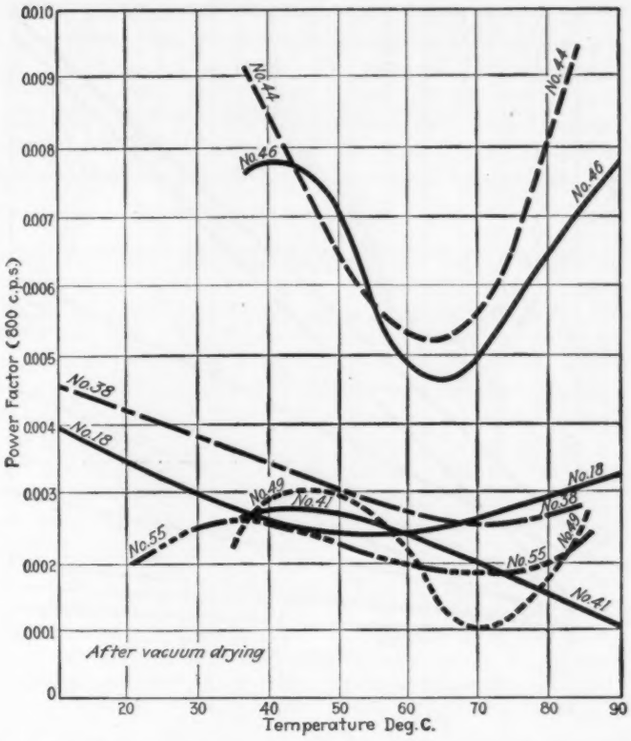


FIG. 5—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF PAPERS

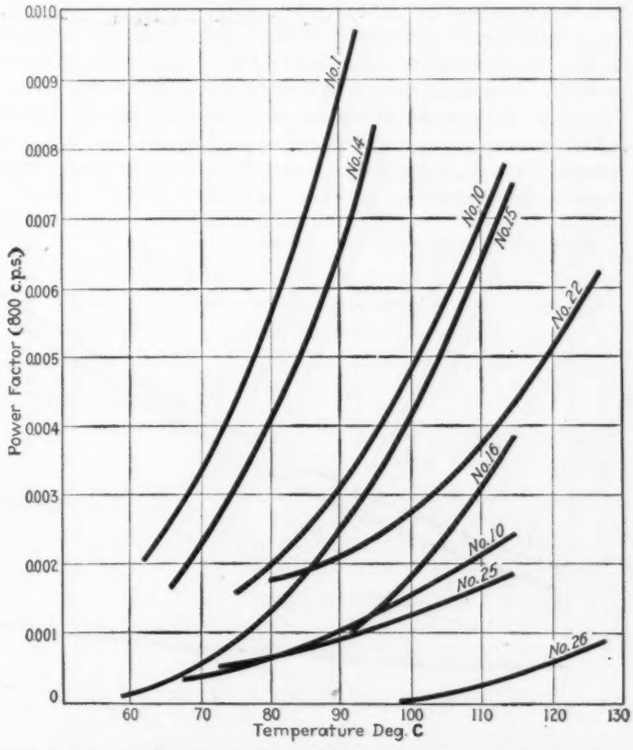


FIG. 6—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF NEW OILS

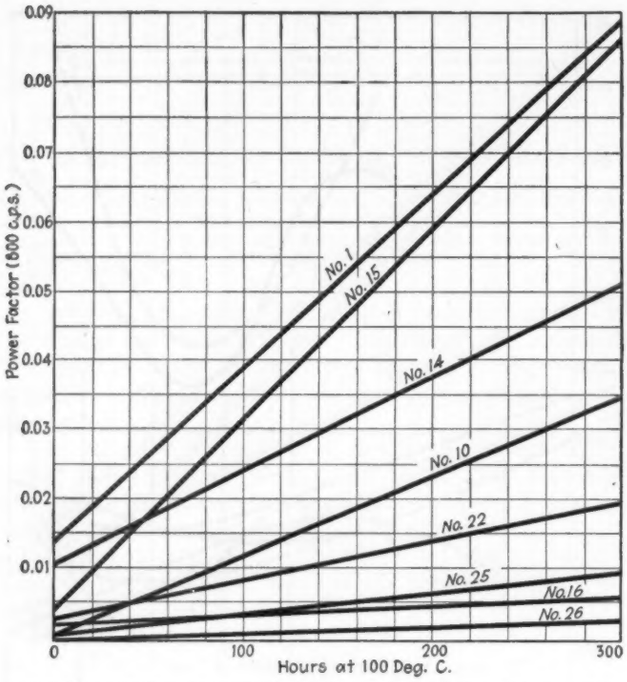


FIG. 7—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF OILS SHOWN IN FIG. 6 AFTER HEATING IN AIR TO 100 DEG. C.

than it can be in single-core cable, where the stress is always radial, and the gap cannot be greater than the thickness of the paper employed. Single-core cables, in fact, show this phenomenon to only a small extent. To prevent it altogether some means must be found of preventing the formation of voids in the dielectric.

One method of doing this is, of course, to employ a hollow core or other oil duct in the cable together with a thin oil so that all expansion occurs into reservoirs at intervals and oil is supplied from these on contraction. This has been applied in some recent lines at exceptionally high pressures, and in such cases the necessary complication may be justified. Some attempts have also been made to apply it in cable of ordinary structure without a definite oil duct, reservoirs being provided at the joints. This is of very doubtful value, since the rate at which oil can flow along a tightly wrapped core is too slow to prevent local expansion if the cable temperature rises rapidly on a sudden increase of load.

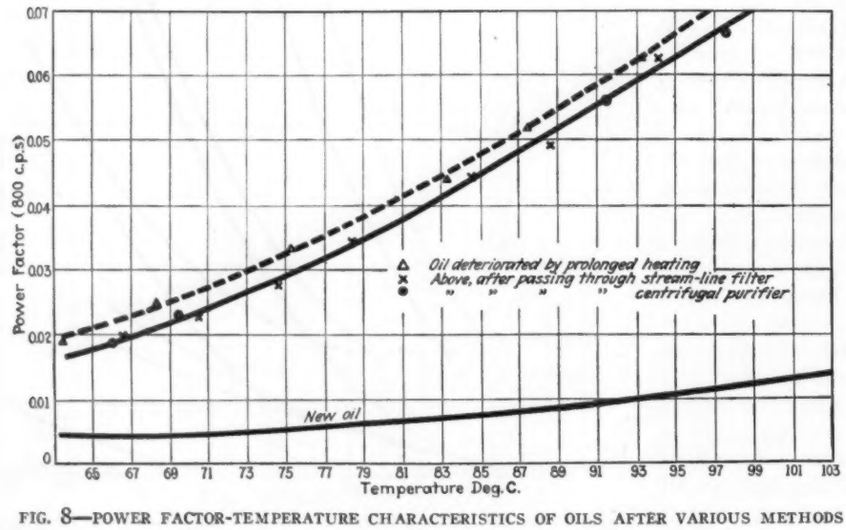


FIG. 8—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF OILS AFTER VARIOUS METHODS OF PURIFICATION

If oil ducts are not used, the risk due to voids can still be eliminated if it can be arranged that they are formed in a part of the dielectric not subject to stress, as, for example, in the worming of an H-type cable having continuous metallized wrappings over the cores. As far as can be judged by experiment, this is actually what happens with such cables. The compound expands on heating and the lead is distended. On cooling, the core wrapping, which is denser and more highly absorbent than the filling, tends to retain the compound at the expense of the filling, so that any voids are formed in the latter where they can do no harm. The result is that the power factor characteristic before and after heating is unchanged and if initial impregnation is good it is independent of applied pressure (see Fig. 2). Such cables are giving satisfactory operation in service in cases where the ordinary belted type has failed, at a much less cost and complication than would be required to secure the same end by an oil-filled duct.

It should be noted that sheath expansion cannot be avoided by reinforcing it in any manner by an external armor. If the impregnation is initially complete, the extension necessary to provide the additional space required for the hot compound is well outside the stretch that can occur up to the elastic limit of the usual armoring materials. The distortion produced is therefore permanent even in an armored cable.

It is possible that in the future other methods of securing stability in service may be discovered, but whatever methods are employed, it will be necessary to add, to the tests used at present in the factory, a test giving a better criterion of stability in service. The comparison of power factor voltage characteristics before and after a load run affords such a test.

Compressed Air Combats Anchor Ice

THE FORMATION of anchor ice in the Oswego River at the dam of a manufacturer thereon has been of such a serious nature at various times as to necessitate a shutdown of the plant for a considerable period. In an endeavor to correct and prevent this condition, the corporation, which now controls the water power rights in this river and supplies power to the manufacturer, has recently installed an unusual system for the disposal of anchor ice by means of compressed air.

The two dams belonging to the company have been equipped with this device and the satisfactory qualities in maintaining service at the intake have been demonstrated. The essential feature of the apparatus consist of heavy brass pipes imbedded in concrete near the bottom of the fore bay, through which compressed air may be released at intervals. One set of 4-in. extra-heavy brass pipes is located directly behind the trash rack and extends across the whole frontage of the refuse interceptors. Another series of pipes is located about 35 ft. upstream and 1 ft. above the floor of the fore bay and likewise extends across the entire distance. Compressed air under 100 to 155 lb. pressure is released by means of a specially designed pop-valve and the first rush of air contrib-

utes largely to the satisfactory displacement of trash and the breaking-up of the ice. The $\frac{3}{16}$ in. holes in the pipes are on $1\frac{1}{2}$ in. centers to allow the escape of air in several directions permitted by the embedded pipe.

Material raised from the bottom by the use of this equipment and ice floating on the surface of the water in the fore bay are permitted to discharge through a secondary spillway located at the side of the dam and extending about 6 ft. below mean water level. Heavier material which has been dislodged from sub-surface positions remains in partial floatation in the turbulent water and passes over this discharge passage. In operation, air is forced through the pipe at such time-intervals as may be necessary, according to conditions of temperature and refuse accumulation.

Because of the efficiency of this device in clearing up the conditions for which it has been designed, it is not necessary to have such a fine mesh or spacing for the bars of the trash rack. This enables a less expensive type of rack to be used and does not restrict the flow of water in the event of corrosion formation on the rods or bars.

Costly Alterations Avoided by Use of Fan Ventilation

By Maurice D. Smith*

SOME difficult problems of providing adaquate ventilation in an underground transformer room were solved recently in a manner that may benefit others who encounter a similar predicament.

The transformer room, which was seven feet underground housed three 75-kva. transformers supplying a power load and two 100-kva. transformers in parallel, supplying a dense lighting load. Under normal operating conditions sufficient cool air would have been supplied through the manhole cover and entrance shaft, but all five transformers were carrying an overload. The power transformers were overloaded during the day. As soon as their load started to decrease the lighting load came on and continued the heat generating effect before enough cool air circulated and cooled off the room, walls, and power transformers. This process continued and maintained a high temperature in the room. As the time of day when the power and light loads overlap had not been reached, it was felt that steps should be taken immediately to prevent a transformer failure when the peak occurred. This, of course, would have meant a service interruption to several large customers.

The first thought was to provide additional ventilating ducts that would admit air to the transformer room and allow the hot air to escape through the entrance duct and manhole cover. This would have necessitated breaking the street pavement and building a duct from the bottom of the manhole to the curb line. But the expense was rather high and besides the entire system, including and adjacent to the transformer room, was to be connected to a network within a few months. This would involve the installation of additional transformers in a room near the one in trouble to feed part of the load now carried by it. The transformer capacity was to be reduced from 425 to 300 kva.

In view of these facts, it was felt that some temporary expedient should be adopted. Upon close investigation it was found that a spare 5-in. lateral duct existed, from the room to a nearby pole. The thought then occurred, "Why not utilize this duct as an exit for the hot air and feed cool air in through the entrance duct and manhole cover?" This was done, and the temperature dropped over 30 deg. F., giving a safe operating temperature.

Forced Ventilation Used

The method employed was to extend the spare lateral ten feet up the pole and to connect the other end through a hose to a blower capable of moving 10,000 cu.ft. of air a minute. The blower was driven by a 110-volt motor connected to one of the lighting transformers in the transformer room. A cylindrical shaped tube of canvas was made, with wooden supports at each end to give it shape. This tube was inserted in the entrance duct up to within twelve inches of the floor. The air was sucked through the holes in the manhole cover down the shaft and then forced out through the lateral duct by the blower.

Recording thermometers installed for two weeks indicated that the proper temperature was being maintained for safe operating conditions. From then on it was necessary periodically to inspect the blower motor, to oil the bearings, and make sure it was still functioning. In this manner it was possible to save several hundred dollars that would have been expended for additional ventilating ducts that would have been required for a period of three months. Also, the public was saved the inconvenience of having the street open for a week while construction work was in progress, with the unavoidable amount of traffic hindrance at a busy street intersection.

Reserves book rights.

"Safety Net" Plan Produces Results

APPLICATION of a "safety net" plan of preventing accidents and finding the cause and remedy for accidents has met with decided success in the organization of the Washington Water Power Company, Spokane, Wash. Enlarging upon the recommendation of the State Department of Labor and Industries for safety inspectors, the Washington Water Power Company discontinued its former safety committee of employees and department heads. In its place, a central safety committee, composed entirely of department heads, was installed. Working with this new committee, a group of 32 safety inspectors keep in constant touch with safety standards of the company, each in his separate group. The inspector makes immediate investigation of an accident in his group and assists in fixing responsibility and in recommending remedies for the prevention of a similar accident.

The safety inspectors report to J. B. Fisken, safety engineer and ex-officio secretary of the central committee. "The 'safety net' has brought in better results than the usual plan of a safety committee," states Mr. Fisken. "We receive many more safety suggestions, and, by having department heads on the committee, better action is secured in getting them adopted. Further, we now have active, aggressive safety leaders in each important group of the organization, which covers sixteen counties in our territory."

The term "safety net" is original with the Washington Water Power Company as applied to the type of safety organization worked out in Spokane.

Substation Motor Inspections

FIRST ARTICLE

By O. M. Ward
Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

FOLLOWING is the motor inspection report form which is used in substation maintenance work on the system of the Milwaukee Electric Railway & Light Company. Motor inspections are made monthly. This form is mimeographed on a sheet 8½x5½ in. In addition to

MOTOR INSPECTION REPORT

Station.....Motor Drives.....Date.....

Motor hp.....Volts.....Frequency.....

Field Connections.....Main Connections.....

Air Gap Top.....Bottom.....Right.....Left.....

A.C. Rings.....Commutator.....

No. of Brushes Changed, including those changed since last inspection .....

Brush Spacing.....Conditions of bearings.....

Was Bearing Oil Changed.....Ground Test.....

Starting Apparatus.....Size of Protecting Fuse.....

Was rotor removed for cleaning and painting.....

provision for filling in specific information, the form includes certain notes for the guidance of the inspector. These notes are:

"This inspection report is to be used for all motors except motors or motor generators.

"By 'air gap right' is meant the right-hand side of unit when looking toward the motor from the end which gives clockwise rotation. Ground tests to be made with a voltmeter on 600-volt d.c. if possible. Give meter number, meter reading and voltage of test. This test to include armature, field and leads, unless otherwise stated."

Space is left on the form following the notes for remarks by, and signature of inspector.

Structural Steel Installed by Welding for $79 a Ton

AN ANALYSIS of the cost of electric arc-welding on the Derry (Pa.) building of the Westinghouse High Voltage Insulator Company, presented by Gilbert D. Fish, of New York City, consulting structural engineer of the Westinghouse organization, before the Affiliated Technical Societies of Boston, indicates the advantages of this application of power. The Derry building is of mill-type construction, one story in height and covers two acres. The total steel tonnage was 337. The purlins were made continuous and designed accordingly, the saving in steel on this item paying for the extra welding with a good margin to spare. The detail design was of "stark simplicity," and the major structural items included 135 18-in. I-rafters on 30-ft. span and six 24-in. I, 115-lb. rafters on 52-ft. span. Each rafter was connected to the column at each end by a single side angle welded to the rafter before erection and to the column after erection. The welding of the angles to the rafters on the ground before erection permitted the shipment of rafters from the mill to the site as plain material, with ordinary mill tolerances in length. It is estimated that the Derry steel work cost about 12 per cent less than the alternative design for riveting. The cost analysis is appended.

ANALYSIS OF STEEL COSTS IN ARC-WELDED BUILDING

Item	Estimate	Average Per Ton
Steel on cars at building	$17.070	$50.66
Erecting and painting	6,232	18.49
Welding and special engineering	3,280	9.73
Complete structure	$26,582	$78.88

APPROXIMATE SUBDIVISION OF ITEMS

Plain material on cars at building, 200 tons at $42.20	$8,440
Fabricated material on cars at building, 137 tons at $63.00	8,630
Erecting and painting, 337 tons at $18.49	6,232
Ground welding, 858 ft. at $1.45	1,240
Welding in place, 1,402 ft. at $0.88	1,240
Welding sketches and special engineering	800
Contract price	$26,582

Short-Circuit Ratio Is Significant

By Leonard A. Doggett
Professor of Electrical Engineering Pennsylvania State College

THE short-circuit ratio of an alternating-current generator is defined as the ratio of two quantities, A to B, where A is the field current necessary to produce rated voltage on open circuit, and B is the field current necessary to produce full-load current on short circuit.

This ratio which has been used in connection with alternators for some years discloses much concerning any alternator. For the majority of alternators now is operation, this ratio runs from 0.5 to 1.4. A short-circuit ratio close to unity is very common in American alternators, while German and French machines are built with short circuit ratios as low as one-half. A low short-circuit ratio means a narrow air gap, less field copper, and, in general, a less expensive machine. Conversely, a high short-circuit ratio means a long air gap machine with good inherent regulation. Roughly speaking, the ratio of the weight of the rotor copper to the weight of the stator copper approximates the short-circuit ratio.

From the point of view of excitation, low values of short-circuit ratio call for a big percentage variation of field current as load comes on. Thus the exciter has a very large variable load, while, with high values of short-circuit ratio, much less change of exciter load is met. An analysis of some hundred alternators shows what may be demanded in a quantitative way of the exciter.

For unity power factor loads, the field excitation at no load will have to be multiplied by 1.9 to give rated voltage at full load, when the short-circuit ratio is 0.6; but only by 1.2 for a short-circuit ratio of 1.4.

For 80 per cent power factor lagging loads, the field current must be multiplied by 2.5 at full load for a short-circuit ratio of 0.6; by 1.5 with a short-circuit ratio of 1.4. Expressed as formulas, these results are

$$\frac{\textit{Field Amperes at Full Load}}{\textit{Field Amperes at No Load}} = \frac{K}{\sqrt{S.C.\ Ratio}}$$

For unity power factor, K runs from 1.4 to 1.5.

For 20 per cent lagging power factor, K runs from 1.8 to 2.0. Of course, these results will be slightly modified by the saturation and leakage reactance of the particular unit under investigation.

A significant statement as to the trend of the short-circuit ratio may be found in the following quotation from page 1,248 of the November, 1927, A.I.E.E. *Journal*, as follows: "On account of the stability characteristics desirable for operation with a 220-kv. transmission line, the Conowingo generators have a short-circuit ratio of 1.25, which is somewhat higher than has been found satisfactory for nearly all other hydro-electric developments."

Utility Research Indicates

Appliance Load Values

Tests show electric ranges, refrigerators and oil burners of great potential importance in raising average annual consumption. Residence service can be made high load factor business

By HARRY A. SNOW

Assistant Controller Detroit Edison Company, Detroit, Mich.

THE average residence customer of the Detroit Edison Company is steadily increasing his use of electric service. In 1917 the average residence customer consumed 319 kw.-hr., whereas for 1927 this figure will be about 540 kw.-hr. In studying the very important problem of the possible continuance of the growth in residence consumption it was decided to determine the characteristics of electric service to three types of appliances, which are rapidly increasing in popularity but which are not yet in wide general use—namely, the electric range, the electric refrigerator and the electric motor used to operate oil-burning furnaces. The use of electric current in these three appliances is large as compared with the use of current in other appliances such as laundry irons, toasters or washing machines, which are used for only a few hours each month, and their effect on average annual consumption is of great potential importance.

Integrating watt-hour meters were installed on 53 electric refrigerators, 55 oil burners and 194 electric ranges located in single homes. The range meters carried demand attachments. Curve-drawing meters were installed on a limited number of refrigerators and oil burners and on three groups totaling 198 ranges located in apartment houses.

This special metering has made it possible to determine annual consumption, daily and yearly load curves, maximum demands, load factors and diversity factors for the three appliances. Special operating characteristics were also observed.

ELECTRIC HOUSEHOLD REFRIGERATORS

In Detroit electric household refrigerators consume 34 per cent more current during the warm summer months than they do during the cooler winter months. For July, August and September, with a mean outdoor temperature of 68.5 deg. F., a group of 53 refrigerators, including eight different makes, showed an average monthly consumption of 51 kw.-hr., as compared with 38 kw.-hr. per month for December, January and February with a mean temperature of 27.4 deg. F.

Electric refrigerators consume a little more current during the daytime than they do at night, because of the higher temperatures generally prevailing during the daytime and because of the opening of refrigerator doors for the admission of food, etc. The daily load curves on 195 refrigerator motors, averaged together, gave an average consumption from noon until 6 o'clock at night 12 per cent more than the consumption during the hours from midnight until 6 o'clock in the morning.

It does not seem to be customary to shut off electric refrigerators during the winter months to save electricity by taking advantage of natural refrigeration. Only one of the 53 refrigerators under test was shut off for the winter. However, it does seem customary to shut off the refrigerator when the house is to be unoccupied for a time. During the summer vacation period the monthly consumption of individual machines under test was erratic, probably because of this fact. In certain specific instances it was known that the absence of the house-

TABLE I—1,000 RESIDENCE CUSTOMERS' DAILY LOAD RECORDS, MARCH

Time	1,000 Refrigerators, Kw.	1,000 Oil Burners, Kw.	1,000 Ranges, Kw.	Lighting, etc. 1,000 Customers, Kw.	Total, Kw.
12:30 a.m.	62	26	30	18	136
1:00	60	24	20	12	116
1:30	58	24	14	10	106
2:00	56	28	7	8	99
2:30	54	30	7	8	99
3:00	52	34	7	8	101
3:30	54	36	7	8	105
4:00	54	40	7	8	109
4:30	54	42	10	10	116
5:00	50	40	13	14	117
5:30	50	46	19	30	145
6:00	52	52	26	46	176
6:30	52	56	79	58	245
7:00	52	56	132	72	312
7:30	52	56	264	86	458
8:00	54	58	395	78	585
8:30	54	52	359	64	529
9:00	54	46	323	58	481
9:30	56	42	267	58	423
10:00	54	42	211	58	365
10:30	54	42	218	50	364
11:00	58	40	224	48	370
11:30	60	38	253	46	397
12:00 noon	58	38	283	38	417
12:30 p.m.	58	38	264	34	394
1:00	60	36	244	38	378
1:30	62	34	214	38	348
2:00	62	34	184	40	320
2:30	62	32	171	42	307
3:00	62	30	158	44	294
3:30	60	30	211	48	349
4:00	62	30	264	48	404
4:30	62	32	389	66	549
5:00	62	32	514	98	706
5:30	62	34	587	138	821
6:00	62	36	659	156	913
6:30	64	38	537	160	799
7:00	66	38	415	164	683
7:30	68	38	280	160	546
8:00	66	36	145	154	401
8:30	64	36	112	146	358
9:00	64	36	79	136	315
9:30	62	36	72	124	294
10:00	60	34	66	104	264
10:30	60	32	59	82	233
11:00	60	30	53	58	201
11:30	62	30	46	42	180
12:00 midnight	64	28	40	30	162
Average load	59	38	186	63	346

TABLE II—AVERAGE ANNUAL CONSUMPTION RESIDENCE SERVICE

	Refrigerator, Kw.-Hr.	Oil Burner, Kw.-Hr.	Range, Kw.-Hr.	Lighting, Etc., Kw.-Hr.	Total, Kw.-Hr
January	34	48	123	61	266
February	40	42	105	53	240
March	42	27	133	46	248
April	46	23	122	45	236
May	46	11	135	40	232
June	46	2	119	37	204
July	55	0	112	33	200
August	46	0	121	34	201
September	53	4	140	37	234
October	52	14	127	45	238
November	43	34	128	52	257
December	39	53	115	57	264
Total	542	258	1,480	540	2,820

holder on his annual vacation was the cause of abnormally low monthly consumption.

The average annual consumption of the group of 53 electric refrigerators, all of which were of a size suitable for use in an ordinary middle-class residence, was 542 kw.-hr. per year. The average electric input to the motors during operation was 249 watts. Of the 53 refrigerators, 32 were driven by $\frac{1}{4}$-hp. motors, 19 by $\frac{1}{6}$-hp. motors and two by $\frac{1}{8}$-hp. motors. This gives a weighted average motor rating of 0.216 hp. or 161 watts.

Recording instrument records indicate that the refrigerator motors were in operation on the average 24.9 per cent of the time. The operation of automatically controlled refrigerator motors is intermittent, but the load on the power station produced by a large group of refrigerators will be a steady load, except for the daily and seasonal variations heretofore described.

The Refrigerator Load

A group of 1,000 refrigerators, similar in make-up to the group of 53 tested at Detroit and operating under similar conditions, would consume 542,000 kw.-hr. per year, with a maximum demand for the group of 89.3 kw. occurring on a summer afternoon and a demand on an assumed December peak of 55.4 kw. (at the customers' meters). This corresponds to an annual load factor of 69.3 per cent for the group and to a diversity existing between the individual members of the group of 2.80. A further diversity which amounts to 1.61 is found in comparing the group maximum with the assumed December peak.

The month-to-month records of the consumption of electricity by individual refrigerators show that consumption has a tendency to be somewhat erratic. In certain cases it was known that the refrigerator had got out of adjustment and was using more or less current than normal. Automatic control apparatus must be more dependable than it is at present to make the current consumption continuously normal to the refrigerator duty.

Electric motors for operating oil burners for domestic furnaces consume a maximum of current during the cold winter months and no current at all during the warm months of July and August. Tests on 55 oil-burner motors operating thirteen different makes of oil burners installed in Detroit homes showed an average consumption of 53 kw.-hr. per month in December and no consumption at all during July and August. The average consumption per motor for the year was 258 kw.-hr.

RELATION BETWEEN ENERGY CONSUMPTION AND NUMBER IN FAMILY

Number in Family	Average Monthly Kilowatt-Hours	Number in Family	Average Monthly Kilowatt-Hours
2	121	6	175
3	127	7	176
4	133	8	214
5	150		

The daily load curves from curve-drawing meters on 205 oil burners, averaged together, showed a decided morning peak from 6 a.m. to 8 a.m. There was a much smaller peak at 7 p.m. and a period of relatively low consumption during the night. The morning peak was sufficiently high to reduce the daily load factor to the rather low value of 65 per cent.

The average annual consumption of electricity by the oil burners under test was 258 kw.-hr. Compared with the annual consumption of a refrigerator, 542 kw.-hr., or of a range, 1,480 kw.-hr. per year, the oil burner seems to be of secondary importance, but even at that, the addition of an oil-burning furnace will increase by 50 per cent the use of current by an average customer.

Oil Burners Vary

The motor sizes for the oil burners under test ran all the way from $\frac{1}{12}$ hp. to $\frac{1}{4}$ hp. and the variation in consumption among different makes of oil burners showed as wide a variation. The average motor rating (on output) for the group under test was 140 watts, and the electrical input to the motors during operation was 172 watts. Since the load on the motors during operation is substantially constant, the kilowatt-hours consumed in a given month will be a measure of the number of hours during which the motor was in operation. The average motor was in operation 41.5 per cent of the time in December and not at all in August.

A group of 1,000 oil burners would consume 258,000 kw.-hr. per year. The peak load for the group would occur on a December morning between 6 and 8 o'clock and would amount to 116 kw. The group would be taking 58.6 kw. between 4 and 5 p.m. of the same day, a time which may be assumed as the time of the peak load on the system.

The annual load factor for a single oil burner is not high, 17.1 per cent, but the load factor for a large group is a little better, 25.4 per cent, because of the intermeshing of the demands of the individual machines.

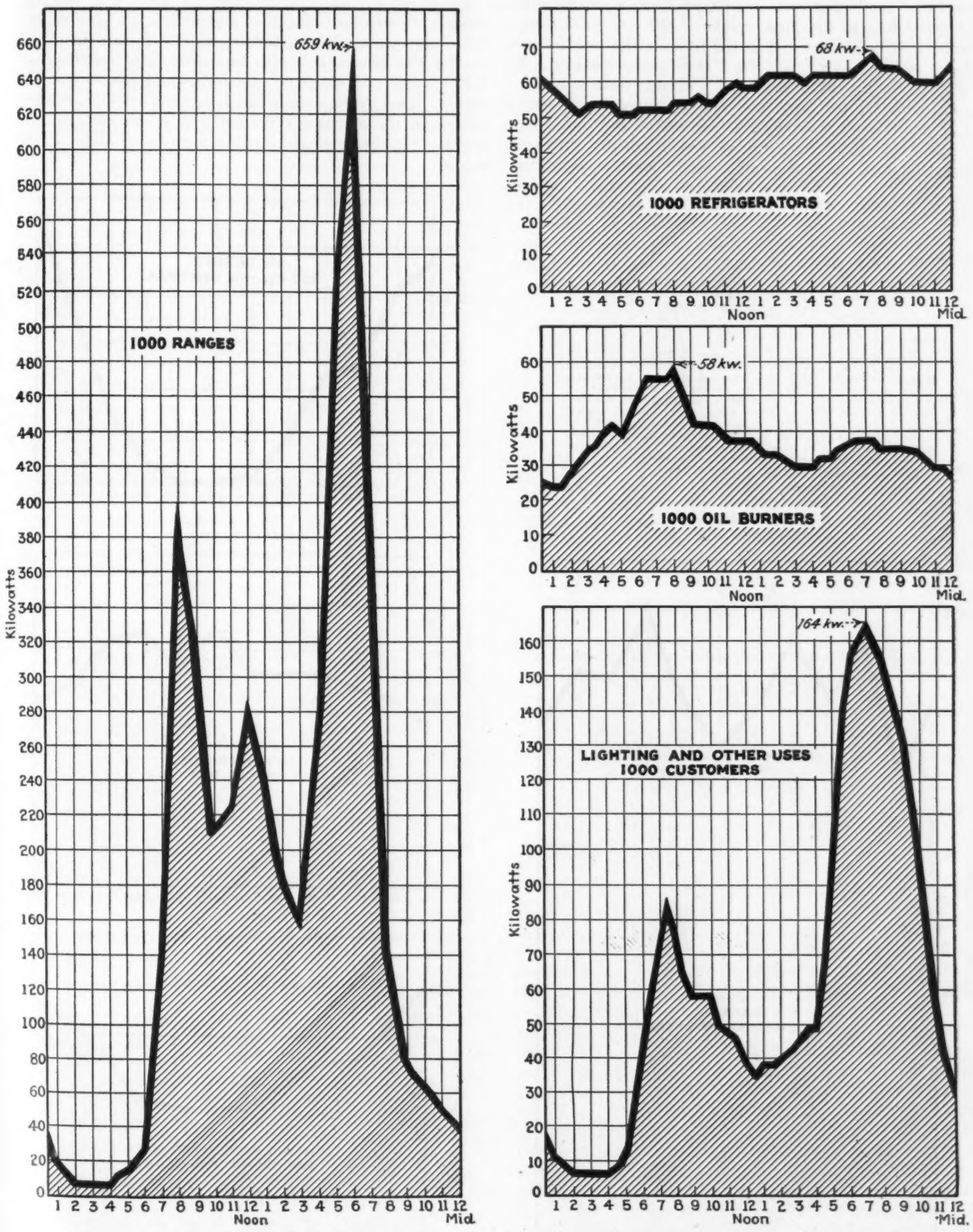
Even during the time of the morning peak only about two-thirds of a large group of oil burners are simultaneously in operation, giving an individual diversity of about 1.5. The peak of the oil-burner load comes in the morning, and the afternoon demand is only about one-half of the morning peak. If it be assumed that the system peak comes at dusk of a December day, a large group of oil burners will have a diversity of about 2, as compared with the system peak.

Influences of Weather

It is obvious that the electrical consumption of a large group of oil burners is dependent upon the outside temperature. Extreme cold weather increases the consumption and warm weather reduces it. The data given in this study are consistent with temperatures prevailing in Detroit during the past winter. The electrical consumptions of different designs of oil burners are markedly different, varying as much as 4 to 1 and the data given in this report apply only to a group embracing the same selection of burners as was made for this test. An attempt was made to have the group selected for test representative.

Domestic electric ranges consume a maximum of current in September (140 kw.-hr.) and a minimum of current in the short month, February (105 kw.-hr.),

but the annual load curve does not show a pronounced seasonal shape. The total consumption for the year was 1,480 kw.-hr. Consumption tests were made on 194 ranges installed in single homes which averaged a little less than seven rooms to the house, and the results were modified after a study of the consumption shown by



Composite Load Curves of 1,000 Residences Produced by Three Major Appliances and Lighting

Range load produces three peaks, the greatest at the evening meal. Refrigerator load increases from early morning until after dinner, but is fairly uniform. Oil-burner load has its peak around 7 to 8 a.m., but is relatively high load factor. The peaks of the major appliances never coincide with one another or with the system peak.

three groups totaling 198 ranges installed in apartment houses.

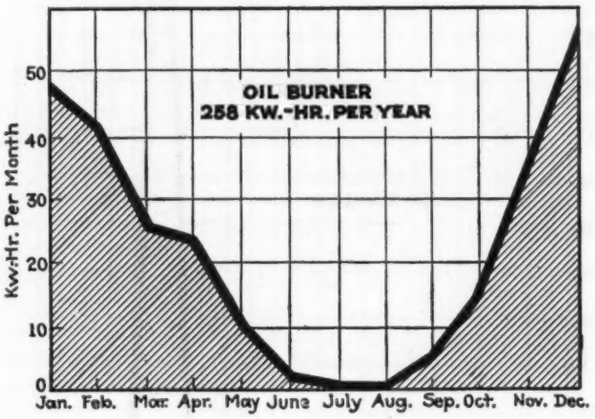
A study of 1,134 daily load curves from 198 electric ranges in apartment houses showed three distinct peaks corresponding to the three meals of the day. Of these, the highest peak occurred at the time of the preparation of the evening meal at 6 p.m. Rating this peak at 100 per cent, the breakfast peak at 8 a.m. was next in importance with 65 per cent and the noonday lunch peak, at 12 noon, was lowest with 47 per cent.

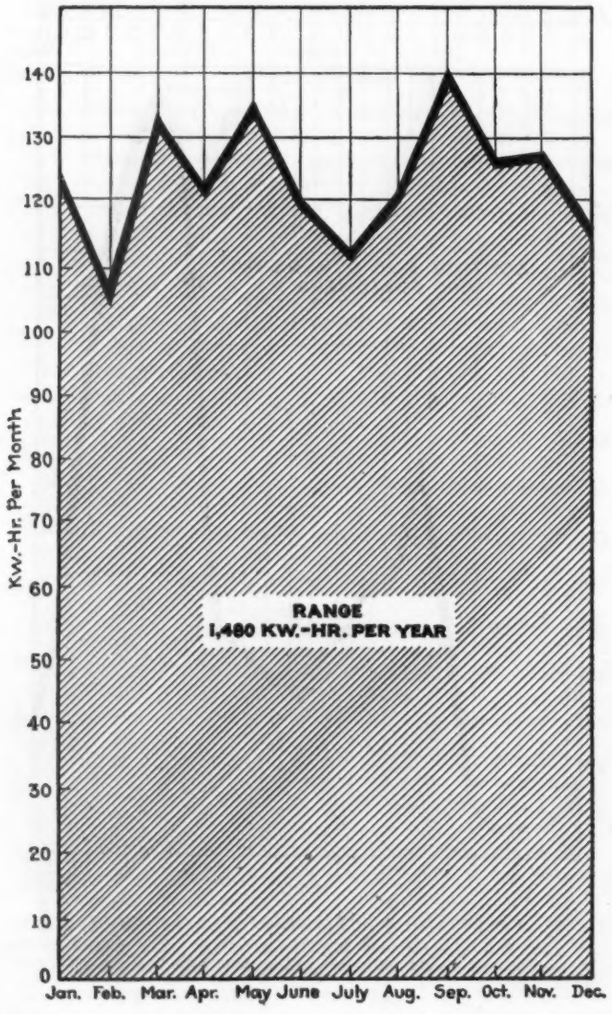
The load curve for Sunday was markedly different from the load curve for an average work day in that the peak came at 11 a.m. when the Sunday dinner was being prepared and this peak was apt to be higher than any other peak established during the week.

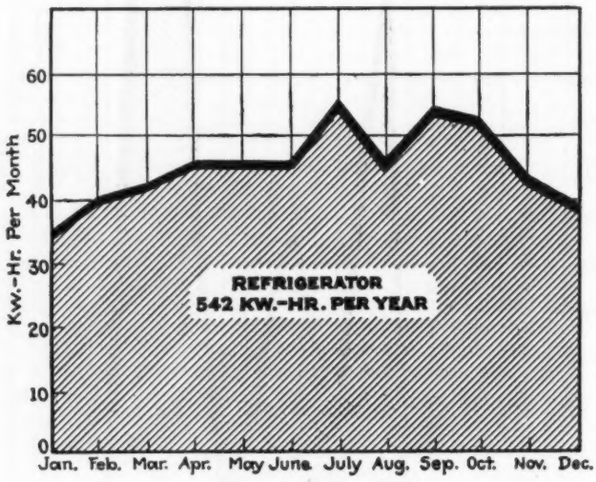
Peaks of current consumption by individual electric ranges are of short duration and erratic in occurrence. Maximum demand attachments on the meters installed on the 194 ranges in single homes showed readings of 5,200 watts per range as the individual maximum demand. The average individual demand of the smaller ranges in the apartment houses was somewhat less, an average for the large and small ranges being about 4,700 watts.

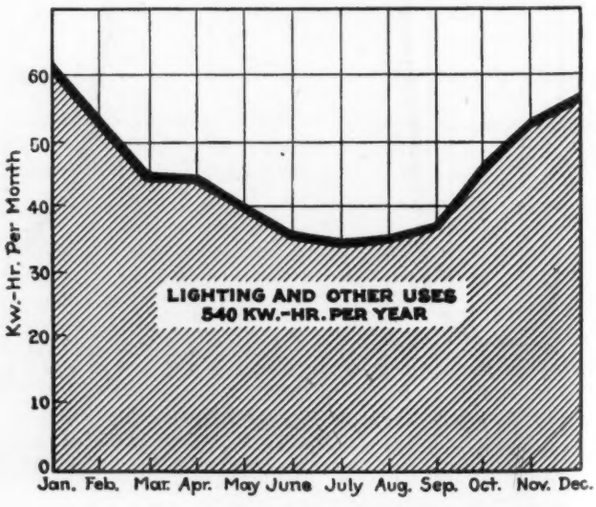
Average Annual Consumption Produced by Range, Oil Burner, Refrigeration, Lighting and Small Appliances

The range consumption varies between 105 and 140 kw.-hr. a month, dropping to its lowest mark in winter, almost an equal amount during vacations, with a smaller drop in the spring. The maximum occurs in the fall. Oil burners, lighting and miscellaneous uses have valleys that reach their lowest elevation about July, oil burners reaching zero at this time and lighting and other miscellaneous uses about half the winter consumption. Refrigerator consumption ascends during the summer, having a slight depression around vacation time.









A single range shows a high individual demand, yet because of the short duration and the erratic occurrence of range load peaks, the peak load of a large group of ranges will come down to 728 watts per range. This produces the high individual diversity of 6.46. Stated in another way, a group of 1,000 ranges will each, at one time or another, draw as much as 4,700 watts, but at no time will the 1,000 ranges, as a group, take more than 728 kw., or 728 watts per range in the group. This high diversity characteristic of range service suggests the possible economy of a distribution system having heavy secondaries and a few large transformers.

Range service as a class has its peak load in September, when the class load is about 17.5 per cent higher than in December and January. Also the peak load for range service comes at 6 p.m., a little later than the usual system peak, which is rarely later than 5 p.m. Assuming that the system peak occurs between 4 and 5 p.m. on some day in December, range service has a class diversity of 2.17 as compared with the system load. Thus, although each individual range at one time or another draws as much as 4,700 watts and a large group of ranges has a class maximum of 728 watts per range, the demand of a large group of ranges between 4 and 5 p.m. on a day in December is only 336 watts per range.

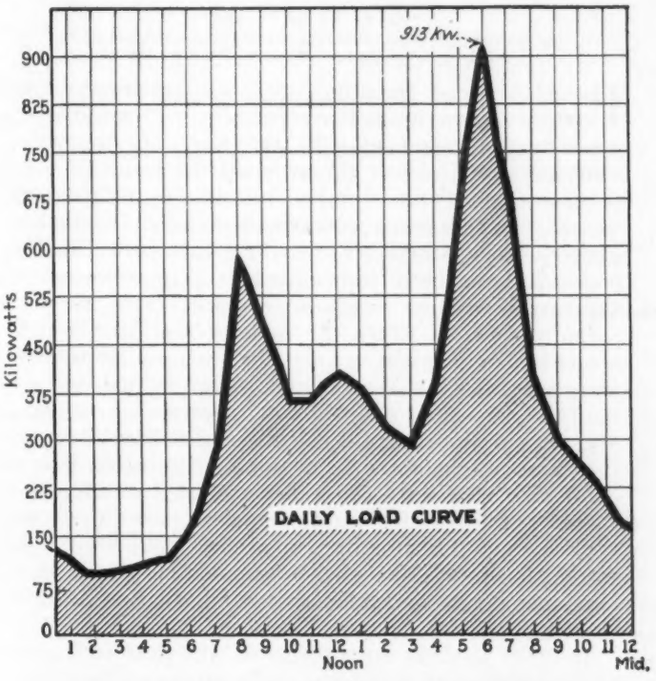
It is true that the annual load factor of one range is very low. A maximum of 4,700 watts and an annual consumption of 1,480 kw.-hr. produce a load factor of less than 4 per cent, but it is also true that a group of 1,000 such ranges has a fairly good annual load factor because of the high diversity among the demands of individual ranges. A class demand of 728 kw. (of which only 336 kw. comes on a system peak occurring between 4 and 5 p.m. on a December day) and an annual consumption of 1,480,000 kw.-hr. give an annual load factor of 23.2 per cent for the large group. Range service requires heavy distribution lines, but it is not so hard on substations, transmission lines and power houses.

In the case of the ranges installed in single houses the number of persons in each family was determined. The table on page 144 shows the relation between the consumption of current and the number of people in a family.

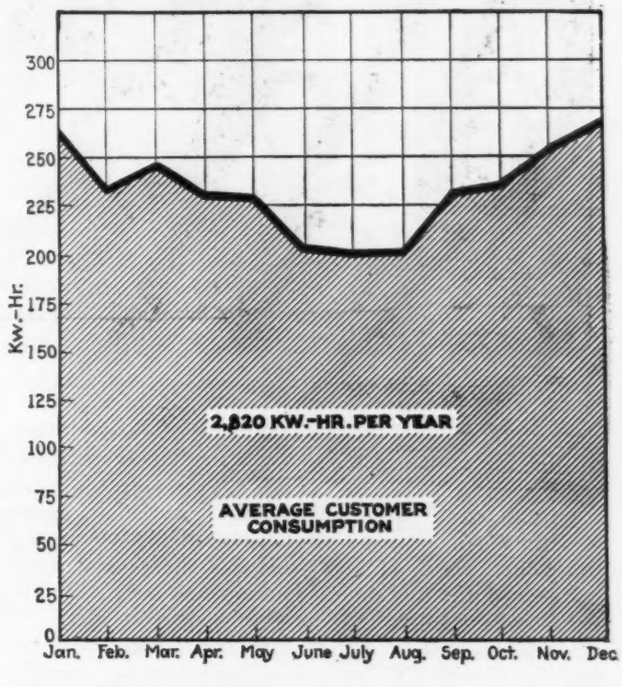
In general, it may be said that an electric range consumes 100 kw.-hr. per month plus 10 kw.-hr. per person for all of the people in the family served by the range.

The operation of electric ranges, unlike the operation of electric refrigerators and oil burners, is not automatic, but reflects the meal habits of the users of the ranges. The figures given are accurate for the single homes and apartments in Detroit.

The illustrations show daily and annual load curves for refrigerators. oil burners and ranges and for the use now made of electricity by the average residence customer in Detroit. The daily load curves are typical of the month of March, as being an average month where seasonal variation is present.



COMPOSITE DAILY LOAD OF 1,000 RESIDENCE CUSTOMERS
Using energy for lighting, range, refrigerator and oil-burning furnace.



AVERAGE ANNUAL CONSUMPTION PER RESIDENCE CUSTOMER
Using three major appliances. Note comparatively small valley during summer months.

The data for the present use of electricity by the average residence customer do not quite represent use for lighting and small appliances only, because there are a certain number of the larger appliances in use, but the error made in assuming that these data do represent lighting and small appliance consumption is not of importance. Starting with the assumption that the average residence customer does not possess a refrigerator, an oil burner or an electric range and assuming further, rather fancifully perhaps, that he can afford to and does purchase a range, a refrigerator and an oil-burning furnace and so superposes their requirements for power on top of his previous requirements for lighting and other incidental uses, we arrive at the conclusion that the customer's consumption would be increased from 540 kw.-hr. per year to 2,820 kw.-hr. per year and that his daily and annual load curves would be as shown here. If all existing small customers were to be transformed into customers like this, public utility companies would have to look to their distribution systems, and possibly to their rate schedules.

Conduit Costs Reduced With Threadless Fittings

By Willis H. Backer
Assistant Electrical Engineer
Electric Bond & Share Company, New York

THE development of a fitting that may be used with fiber duct material and thus permit the substitution of less expensive construction for the commonly used iron conduit has led to major economies in the building of generating stations and substations, as well as in outdoor switchyards. Power and control cables, with the exception of single-phase alternating-current cables, formerly required iron conduit ranging in size from ½ in. to 4 in. The cost of engineering and construction of so many

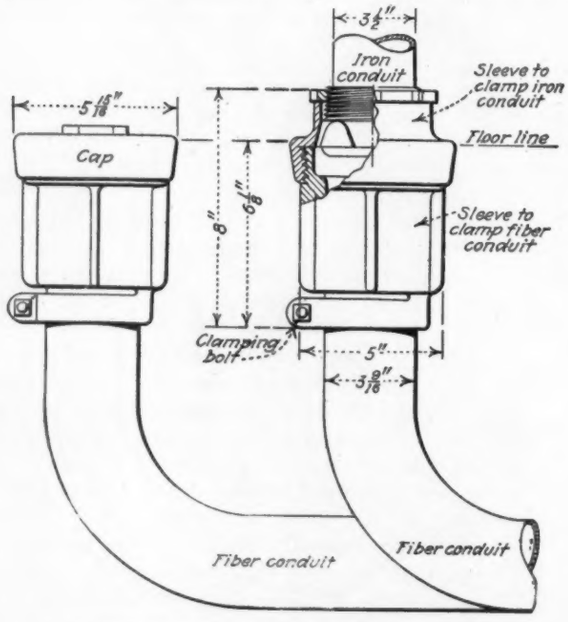
CONDUIT CONNECTORS INSTALLED, BEFORE POURING CONCRETE

sizes of pipe offset the savings obtained through the use of the particular size required for power field leads, control, etc.

In almost all cases the conduit is buried in concrete, so that the mechanical strength need not be great and fiber duct, which is less expensive than metal, may be considered for this duty. On some properties the engineers have standardized on 2-in. and 4-in. sizes. This permits savings in engineering costs, and the material may be obtained without delay and may be installed in the early stages of construction. For example, in addition to engineering cost reductions there is a saving in material costs.

COMPARATIVE COSTS FOR IRON AND CONDUIT INSTALLATION

	2 In.	4 In.
1,000 ft. of iron pipe	$258.00	$793.00
1,000 ft. of fiber conduit	85.00	124.00
	$173.00	$669.00
Fittings required:		
47 at $3.70	$173.90	.....
69 at $9.60	.....	$662.40
	$0.90	$6.60



A FIBER-TO-IRON CONNECTOR FOR 3-IN. CONDUIT

Intelligent Analysis vs. Expedients to Avoid Trouble

By G. B. McCabe
Technical Engineer Electrical Operating Department, the Detroit Edison Company, Detroit, Mich.

IN ANY large operating organization, practices and methods grow up and are continued. Some may be good or bad; some may be the fruit of intelligently analyzed experience or the accumulated result of small carelessnesses. This condition has manifested itself numerous times on underground systems in which the handling of cable and the art of making joints and installing potheads have been transmitted from journeyman to apprentice without much supervision from technical authority, and in which the cable voltage has been increased in only comparatively small jumps. It is necessary that cable workers should be acquainted not only with the mechanics of good work, but also, in adequate degree, with the electrical conditions that are the reasons for those mechanics. It is quite conceivable that an apprentice who learns to make a good joint thinks he should not leave any sharp points of solder or loosely applied tapes because they spoil the looks of the job and are a disgrace to a good workman. He should know, also, that points of solder and soft insulation definitely weaken the joint.

In order to make such points as this clear to the men who do the actual work, the electrical operating staff of the Detroit Edison Company has prepared a lecture on underground cable which has been delivered twice to groups of operating and construction men. It was first given last spring to the 200 cable installers and splicers, and last December it was presented before 350 construction, operating and maintenance men, the majority of whom are directly concerned with the installation of cable terminals. The subject was covered exhaustively, from the manufacture of the cable to the last joint in the manhole. All details of installation, handling on reels, pulling in, joints, pothead terminals, etc., were discussed. The effects of short bends, of moisture on the hands of the splicer, of dirt on the insulating tape, of loose tape wrapping, of voids left in joints and many other points were demonstrated with high-voltage breakdown tests. Lantern slides illustrating both good and bad practices were shown.

It was felt that this information, presented in words, pictures and experiments, could not but have good effect, even in an organization where good workmanship is the rule and not the exception. This idea is borne out by the fact that there has been a diminution in the already small number of cable joint failures since the talk was first given last spring.

"Caveat Emptor" Policy

Suicidal if Applied to Investor*

Some tendencies on the part of investment bankers and utilities show disregard of the rights of the ultimate provider of necessary capital

By JOHN W. STEDMAN
Vice-President Prudential Insurance Company of America

THE annual aggregate permanent investment in public utility bonds of the life insurance companies incorporated in New York and New Jersey is so substantial a factor as to be worthy of being taken into account when drafting an indenture. Purchases in the years 1924, 1925 and 1926 totaled more than $360,000,000.

I am unfamiliar with the laws governing the investment of life insurance funds in other states, but I would direct your attention to the fact that the statutes of New York and New Jersey prohibit a company from entering into an agreement of reorganization without the approval of the Insurance Commissioner, the legislative intent being to control any change in the character of the company's investments. As the modification clause, which makes conditional upon the vote of a percentage of the bondholders, instead of unconditional, the promise in the bond to pay principal and interest on a fixed date, is, to repeat, an incipient reorganization in the furtherance of a compulsory debt-readjustment at some time in the future, it is apparent that the life insurance buyer of bonds which may be so modified, must, before confirming each purchase, obtain consent from the authorities at Albany and Trenton. Obviously, such a course of conducting one's business would be so grotesquely impracticable as to be out of the question.

Much attention is paid to public relations between the utility and its consumers. Less is heard of public relations between a company and its shareholders. In certain respects, the latter relations are more important than the former.

The suggestions here presented by the representative of one of the nation's largest investors merit careful consideration both by the utility and by his banker.

A discussion of the objections on the part of the investor to the modification clause, as used more particularly in public utility indentures, leads me to speak to you about another closely related matter, which, though understood by the lawyers who advise you, is, I have found, unknown to many of you. A bond in its form, that is, in the manner in which it is worded, may be negotiable or non-negotiable. Right here and now, please get rid of the commonly held but fallacious notion that a bond is a negotiable instrument merely because, being payable to bearer, it is transferable by delivery. Briefly, in the language of laymen, a bond, to be negotiable in form, must promise unconditionally to pay to order or to bearer a certain amount of money, with specific interest, on demand, or on or before a fixed date. Should there be in the bond any reference stating or implying a purpose to subject the bond to the terms of the mortgage or indenture, the unconditional character of the obligation is impaired and its negotiability destroyed.

You gentlemen and the borrowers of capital have been revelling for about two years in a sellers' market. In such a period it is not surprising that the strong wine of success and prosperity should go to your heads, making you disregard some of the reasonable needs of the investor, making you forget that the capacity of the buyer is not boundless and that his appetite can in time be dulled by constantly boosted prices. This was the reason for the painful attack of indigestion last June, from which the bond market did not recover for perhaps six weeks. Such a setback, it seems to me, should serve as a wholesome reminder to the banker who has heeded only the dictates of the borrower, and to the borrower who has taken a grasping and short-sighted position, that consideration for the requirements of the investor, especially the large long-term institutional investor, will, in the long run, prove best.

DUTY TO BORROWER AND INVESTOR

In contrast to the selling-agency type of distributor, there are also some that feel that they owe one distinct duty to the borrower and another to the investor. Their duty to the former, they believe, consists in giving advice as to what form of financing should be adopted to preserve or enhance most effectively the credit of the company, in paying a price for the new securities which conscientiously measures the underwriting risk, and in fixing a redemption price which, taking into account the term and character of the obligation, will penalize neither the borrower nor the investor. Their duty to the latter they express very simply as insistence upon adequate protection, either in credit or in security, buttressed by

**From an address delivered at the sixteenth convention of the Investment Bankers Association of America.*

the inclusion in the indenture of all legitimate provisions such as I have already described.

On the subject of competitive bidding for railroad bonds and equipment trust certificates, it has occurred to me that you might be interested in learning the views of a professional investor on a large scale of collective capital, who has had the opportunity of watching the fate of all offerings submitted to him in different kinds of markets. In a weak and demoralized market, the borrowing corporation never realizes a fair price unless its banker comes to the rescue. In a slow and falling market, the successful bidder or group of bidders, having too narrow a margin of profit at even the very full retail price they fix, are not sufficiently fortified to hold this price in the face of a general decline; and, failing to make many sales because the investor is not attracted, they are forced to offer their holdings at lower and lower figures. The price or basis at which the bulk of the issue is finally disposed of is a false criterion of the railroad's credit, and as such injures the market for its securities. Needless to say, it is the large investor who, in picking up a bargain, rings down the curtain on a drama of melancholy futility.

Price Depends on Market and Bidders

On the other hand, in an active and rising market, the bidders, time and again, pay approximately the price—and often above the price—at which similar securities are offered in small lots, in the expectation that in a few weeks an advance in the general level of quotations will reconcile the investor to paying the dealers' profit, and as often as not their expectations are realized. Not infrequently a dealer, either in the class I have characterized as consisting of those of various resources, who originate no business and may or may not employ salesmen, or in the class made up of those who are engaged in "hunting for investments for the investor," in a desire to control the marketing of a new issue, yet knowing the danger of operating on too narrow a margin of profit, will approach the large institution with the proposition that the institution become a silent partner by agreeing to buy a very substantial part of the issue at one-quarter of 1 per cent profit, but at a price or basis a little below the true index of the credit of the railroad. When it comes to determining what basis is indicative of the railroad's credit, one of two things always happens: either the dealer and the institution see eye-to-eye, in which case their bid is invariably topped, or they disagree, the institution dropping out and the dealer joining with others in buying the issue at a fancy figure. In either event, the large and careful investor is disappointed.

The trouble with the speculative or over-optimistic bidding obtaining in an era of intense competition is the resulting frequent failure to get a substantial part of the issue into the strong-boxes of permanent investors. To sum up then: it would seem that the interests of the borrowing corporation, and, to a lesser degree, of the investor, would be best served by limiting public supervision to the fixing of minimum prices and by allowing the borrower liberty in negotiation and the benefit of the judgment of experienced bankers. In function the banker is often likened to the distributor of the products of farm, factory, mill and mine; but is not such a conception superficial, in that it overlooks the fact that one who deals in credit is required to give advice and counsel? Competition in the distribution of a consumable commodity has its place in the economic scheme of things, but to compel the well man, seeking preventive advice or treatment or the sick man seeking a cure, to engage the doctor or surgeon who offers his services for the lowest fee, is manifestly preposterous.

In concluding, I might observe that the present practice of houses which originate new financing of allotting to the members of the selling group an aggregate amount of bonds considerably in excess of the face amount of the issue is both a confession of the speculative and temporary character of a substantial portion of the initial sales and an attempt to neutralize its effect by creating an artificial shortage to absorb the inevitable subsequent re-selling. Just how to discriminate, more successfully than has been done in many instances within the last year, in favor of the legitimate permanent investor is, I appreciate, a difficult problem. The firms in the fourth and fifth groups, which I have defined as those who originate no business but who may or may not employ salesmen, will not wish to have their profits decreased through curtailment of their allotments for the purpose of permitting the houses of issue to place larger amounts directly with the large investors. Yet might it not be feasible to arrange it so that the principals withhold for a week, for the account of each participant in the selling group, a certain percentage, say, 10 per cent, of his allotment, to be devoted to making sales to such investors? This suggestion has, perhaps, undesirable features, but are they not outweighed by the attainment of the end sought?

My parting message is that you be not content with a knowledge of the elements which go to make up credit and security, but make yourselves more familiar with the legal aspects of your business, which affect not only yourselves, the borrower and the trustee—your lawyers are sure to safeguard you and them—but also the investor.

Have Put Houses in Order Financially

By J. F. Owens
Vice-President & General Manager Oklahoma Gas and Electric Co., Oklahoma City, Okla.

THERE IS every reason to believe that the marvelous growth of the electric industry which obtained in 1927 will continue throughout 1928. Many companies have taken advantage of the condition of the money market to put their houses in order financially and thus enter the New Year in splendid shape. It is evident that, while the industry as a whole is preparing to meet all demands that may be made for increased output and is in a position to finance improvements necessary to meet these demands, there is noticeably an abandonment of what, in some quarters, amounted to a somewhat reckless enthusiasm that, if continued, cannot but result in the payment of prices for properties that will be doubtful of justification, even by mortgaging future earning power. Altogether, I believe the industry is healthier and in a stronger position than at the beginning of 1927.

Much was done last year to acquaint the public with the basic facts of the industry, on the theory that the public is fair when it knows the facts. A vast majority of electric companies in the United States enjoy good public relations as a result of having continued a frank, open, above-board policy toward the public.

So thoroughly has this policy proved itself, that it is a rare thing to find a utility executive not following it. As long as our electric companies adhere to this policy there need be no fear for the future of the industry.

How Standardization Procedure Affects the Industry

By A. Penn Denton
President Denton Engineering & Construction Company, Kansas City, Mo.

THE electrical industry is undertaking today a program in market building that will require the closest co-operation among all branches of industry if we carry it through to completion. This market building, while primarily a sales problem, has to do with the adequate rewiring of sixteen million homes which are now using electricity so incompletely. The National Electrical Code provides us with many types of interior wiring with which to wire these homes, but with all of these methods we have not reached a place in the development of our industry where it can be said we have no further need for progress in the art of wiring.

The electrical wiring standards of the present code have been 35 years in the making, and yet it has been only within the last four years that a procedure has been adopted by the industry whereby order has replaced haphazard revision of old standards and the making of new ones for wiring installations.

Our electrical industry has not yet realized the possibilities of this new procedure. It is still concerning itself with many old ideas and traditions in code making which should have been discarded years ago. Every type of wiring given us in the code today will prove helpful to our industry in extending our market for a wider use of electrical service. Our standardization procedure from this time on must protect each type of wiring according to its merits and at the same time permit of new developments and progress of the art. Under the old order of code revision the separate industry groups did not work together in providing the public with the best possible electrical service. For that reason many of the wiring standards of the code were too often commercial issues which seldom represented the best co-ordinated thought of our engineers and commercial men.

The basic factor underlying the standards for wiring installations of the code is safety from the standpoint of the fire and life hazards. No attempt was made for years to provide in the code due consideration for use and occupancy features of the different wiring methods. Rapid strides have been made in improving all kinds of building materials and construction, while those interests responsible for improved wiring methods lagged far behind other industry development. The public demand in all sections of the country for better and safer wiring has within recent years brought continually to the attention of our electrical committee of the National Fire Protection Association the need for recognition in the code of the "Where" and "How" all types of wiring may be used. The administrators of our code are asking for this treatment of future standards, while the manufacturers, the central-station companies, and the contractors are beginning to realize the great importance of such treatment.

We have, therefore, reached the place in our program for an orderly improvement in the revision work of the code, where each group of our industry must recognize its individual responsibility. Our interior wiring situation demands the co-ordinated efforts of all industry groups. The wiring standards must all be protected for the public good. This means that no group or single interest within a group may exploit some type of wiring for personal or selfish reasons. No one interest can control and it will be only through a united industry effort following the splendid procedure which we now have set up that will provide the safe, efficient and adequate wiring installations of the future so necessary to the success of our building the great future electrical market.

The electrical field service of the N.F.P.A. has accomplished much in the aid it has given the electrical committee, and particularly the article committees, but this field service work must be greatly supplemented by individual group action along these same lines. There is an immediate need for a code and standards staff in the National Electrical Manufacturers Association. The same need exists in the National Electric Light Association, the International Association of Electrical Inspectors and the Association of Electragists, International. All of the group staffs for code and standards work can materially strengthen the united and constructive participation of its own organization in bringing about an orderly control of our wiring situation for the good of all. All of these staffs need to be strong, friendly, courageous, far-seeing and free from bias to ward or against any unit within their particular branch of the industry.

Let each group of our industry take unto itself the responsibility which rests upon it. May we frankly discuss these problems in our electrical field service committee for our common good. Then and only then can we hope to build that public confidence which, in the last analysis, is all important to the future expansion and growth of the electrical industry.

Cost of Adding Coal Handling Facilities

THE INSTALLED cost of a coal-handling system added two years ago to an Eastern Tidewater central station has recently been itemized by the engineers of the public utility company for which the work was done. The major equipment consisted of an unloading tower of 300 tons per hour capacity, a 600-ton per hour Bradford breaker, a 36-in. Stephens-Adamson belt conveyor system, two 100-ton per hour bucket elevators and two 200-ton per hour Merrick weightometers. The overall capital outlay for this work totaled $233,467, as itemized in the accompanying table:

ITEMIZED COST OF COAL-HANDLING INSTALLATION

Unloading tower, Boston Steeple tower type, Mead-Morrison 55-ft. boom, 375-hp. hoisting motor, 80-hp. trolley motor, 30-hp. propelling motor, 1.5 ton grab bucket	$60,003
Bradford breaker, 125-hp. motor, breaker and cleaner type, complete with foundation, supports, and housing	31,913
Conveyors and weightometers	
36-in. belt conveyor, 372 ft. c. to c., $\frac{3}{4}$-in. 6-ply belt, 36-in. Sacon carriers and returns, 30-hp., 550-volt, 3-phase motor with push button and station control	18,924
36-in. belt conveyor on steel channel stringers, inclined type, 137 ft. c. to c., size as above, 50-hp. motor, 2,300 volts	6,435
36-in. belt conveyor, 7-ply, dimensions as above but 572 ft. c. to c., 50-hp. motor, 550 volts	31,656
Two 100-ton per hour bucket elevators, vertical link belt type, 93.5 ft. c. to c., each complete with 25-hp. motor and two reciprocating type feeders driven by 10-hp.	12,418
30-in. belt conveyor, 30 ft. c. to c., 5-hp. motor	3,850
30-in. belt conveyor, 124 ft. c. to c., 15-hp. motor	6,705
Two 30-in. belt conveyors, 61.5 in. c. to c., each complete with 10-hp. motor and control, T-rail track, etc.	9,545
Two 200-ton per hour Merrick weightometers for 30-in. belt	8,368
Miscellaneous equipment	
Trolley and feed wires for raw coal handling equipment	5,255
Structural steel and chutes for conveyors	26,737
Coal sampling crusher	541
	$222,350
Contractor's compensation	11,117
	$233,467

Water Heating—Good Business or Bad Business?

By L. B. Hutton
Chief Engineer Southland Electric Power Board, Invercargill, New Zealand

SUPPLY authorities are constantly looking for new sources of revenue from the sale of electricity. It is not long since they discovered the value of the electric range load. But, wherever an electric range is sold, there arises the question of an adequate supply of hot water. Any house can do without an electric range, but no household can be without its hot water.

What more natural, then, than that the question of heating water by electricity should today demand the attention of electric supply authorities, and the tendency seems to be toward an exploitation of this form of revenue. There is just a question, however, whether it is the supply authorities who are exploiting the field or the water-heating field that is exploiting the supply authorities. The danger lies in the fact that water heating demands a low rate. Electric power for water heating can reach the consumer: (1) direct from the authority which generates it; (2) from the generating authority, through another authority which purchases in bulk, and retails it.

ELECTRIC POWER COSTS

Size of Element in Watts	Cost per Year	Cost per Day	Units Available per Year	Units Available per Day	Cost per Unit
500	$25	6.85 c.	4,380	12	0.57 c.
600	30	8.2 c.	5,256	14.5	0.57 c.
700	35	9.6 c.	6,132	17	0.57 c.
800	40	11.0 c.	7,008	19	0.57 c.
900	45	12.15 c.	7,884	21.5	0.57 c.
1,000	50	13.7 c.	8,760	24	0.57 c.

Dealing with the first of these, if we take as a basis that firm power cannot be made and sold at much less than $20 a horsepower-year—equal to about $25 a kilowatt-year—and assuming that this lowest rate is granted for water heating, we find that the consumer's cost, on the flat rate—that is, purchasing the kilowatt—works out at about 0.285 cent per unit. This would be an exceptional quotation, but even if he bought the kilowatt at $50 for the year, his water heating would cost only 0.57 cent per unit. One can imagine that so popular would this service become that the generating station would gradually be called upon to supply more and more of its power at an unremunerative rate, for, even at $50, the return per unit is far below what the average domestic service unit is sold at today.

The accompanying table sets out the cost per year, per day and per unit for power purchased on a flat rate of $5 per 100 watts per year. It cannot be claimed that the 100 per cent load factor, as represented in the "units available" column, is unattainable, because the large reservoir water cistern, properly lagged, lends itself particularly to the high load factor. No housewife can put a 100 per cent load factor on an electric range; but thousands are already doing it on the water heater.

Then there is the second case of the municipality which purchases from a generating station in bulk on a kilowatt or kilovolt-ampere basis—perhaps on a flat rate, perhaps on a sliding scale. This might take the form of so much per kilovolt-ampere for the first 1,000 kva. and a smaller sum for the remainder. If we assume that a municipality purchases in bulk at $50 per kilovolt-ampere per year on a half-hour peak demand, and that for a certain year its peak reaches 2,000 kva., then it has at its disposal 17,520,000 units, and it proceeds to sell them to best advantage. It will be unable to sell them all unless its system load factor reach the ideal of 100 per cent and its system power factor be high; but it will always be aiming at this ideal. Provided it does not exceed the 2,000 kw. peak, the unit cost is:

At 100 per cent load factor	0.570c.
90 per cent load factor	0.634c.
80 per cent load factor	0.713c.
70 per cent load factor	0.816c.
60 per cent load factor	0.950c.
50 per cent load factor	1.142c.

At whatever point one may start, the load factor of a system tends to build up, and the unit cost will consequently fall. The retailing supply authority, watching its conditions carefully, can make such arrangements from time to time as will enable it to sell its 2,000 kw. of power over and over again and the time will come when it can quote an absurdly low figure for off-peak water heating.

So far as the generating authority is concerned, therefore, it has arrived at the same point as in the first case considered—that of supplying direct to the consumer on a flat rate—and neither of the pieces of business can be considered eminently satisfactory.

There are many cases where generating and supply authorities are cursing their long-time contracts at low rates. The rates have been far too attractive, and business which would give a much higher return has had to be passed by. There are also many supply authorities which are faced with the need for extending their plants, the attractive rates quoted having accounted for all their present capacity.

Note—Wholesale power at or near a generating station might, in some cases, be had at a figure of $20 a horsepower-year at 100 per cent load factor. But this represents the extreme case and does not consider the heavy investments and losses involved in transmission and distribution of small loads to water-heater customers scattered over a wide area. Rates would be much higher than those quoted and yet many properties find it possible to make a profitable rate for water heating and one which encourages this business.—Editors.

Southern Cement Mill Electrified

ALTHOUGH it is the practice of many cement mills to produce their own power, since the enormous amount of available waste heat permits economical generation, the new plant of the American Portland Cement Company at Foreman, Ark., will, when completed, be electrified throughout and will use purchased power, according to E. W. Vennard, commercial manager of the Southwestern Gas & Electric Company. The initial capacity will be 3,000 barrels a day, with provision for increased production. A connected load of approximately 4,500 hp. will be composed of motors ranging from fractional horsepower equipment to 800-hp. synchronous machines driving the tube mills. Approximately 16 kw.-hr. will be required to manufacture each barrel of cement, a total of 1,440,000 kw.-hr. a month.

The cement company, through its contract for purchasing power from the Southwestern Gas & Electric Company, avoided a potential expenditure of some $500,000 for a power station at the plant and receives energy from the utility at a lower rate than the equivalent of private generation, even though the fuel charge be neglected in the computation of the latter cost. Sustained service is offered by the extensive transmission line facilities of the supplying utility.

EXTERIOR OF THE GEORGE E. KEITH FACTORY NO. 11

Improved Electrical Service

in a Modern Shoe Factory

Plant of the George E. Keith Company illustrates latest practice in light, heat and power applications. Flexibility of operation assured by distribution system layout

By K. D. HAMILTON

Plant Engineer George E. Keith Company, Brockton, Mass.

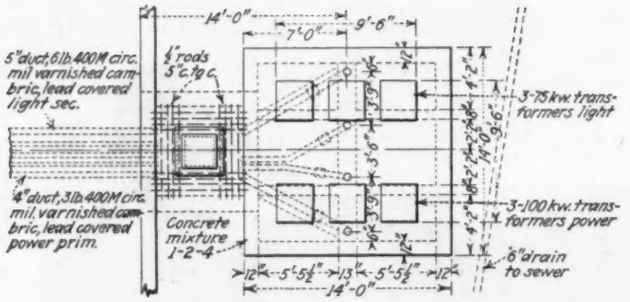
IN THE design of the George E. Keith Company's latest factory, designated as No. 11, at Brockton, the use of electricity was a dominant factor. For lighting and power service no other agency was open to consideration, owing to the well-known advantages of electrical illumination and the electric motor drive. Within the past decade the use of electric heating in specialized applications in shoe manufacture has attained remarkable headway, and this factory naturally affords many examples of this class of service.

The shoe industry has kept pace with developments in reinforced-concrete building construction, as appears from the accompanying illustration of Factory No. 11. This industry today appreciates the importance of investing in permanent construction, where maintenance cost can be reduced to a minimum and yet provide that flexibility of operation which is so imperative in shoe manufacturing, where styles are continuously changing, necessitating the removal of machinery from one portion of the building to another to keep pace with the ever-changing process that enters into the production of the shoe.

This factory (No. 11) differs radically from the ordinary reinforced-concrete building, although it has the appearance of a strictly concrete structure from the exterior, with the advantage of an extreme width of bay and window area, with exterior pilasters spaced 20 ft. apart on centers. The interior was designed to secure the advantages of slow-burning mill type construction, which allows a flexibility of movement of processes and machinery that is less apparent in a factory with concrete floors and large reinforced-concrete columns.

The interior posts are spaced on 10-ft. centers, the floor, however, consisting of 4-in. planks laid on heavy hard pine girders with an intermediate hemlock floor, topped by a high-grade factory maple wearing surface. This building is 400 ft. long by 60 ft. wide, consisting of four floors and a basement with a headroom of 12 ft. Its interior construction differs materially from that of the ordinary concrete factory, in that the wooden girders are hung from the concrete lintel by means of a special steel support. This allows us to obtain a maximum window area, throwing the daylight to the interior of the factory and allowing operators to use machines at distances from the windows that heretofore were considered impractical.

The shoe industry does not demand a heavy floor load, and for this reason the floors were designed to carry



DETAIL OF TRANSFORMER PLATFORM FOUNDATION WITH PRIMARY AND SECONDARY CONDUIT LINES

only 125 lb. per square foot. In addition to obtaining a light floor load, the wooden construction lends itself admirably to securing machines to the floors and to the boring of holes for piping. It also facilitates the movement of machinery. It eliminates the hard concrete floor, which does not provide an ideal working surface; does away with the noise and vibration that are so apparent with high-speed machinery on a concrete floor, and above all, provides a clean, smooth wearing surface, which is not continuously being disintegrated by pushing trucks over concrete. It also eliminates the dust that is frequently apparent where many racks are moving in a reinforced-concrete factory.

Energy Consumption 2.57 Kw.-Hr. Per Pair Shoes

These features as briefly outlined tend to provide conditions wherein lighting costs are extremely low. Lights are used in this building only during extremely dark weather or in the winter, and then only for a few hours in the afternoon. The average energy consumption for heat, light and power in this structure, when operating at a capacity of 3,000 pairs of shoes per day, is 350,000 kw.-hr. per year. The electric service layout in this factory, as well as the machinery installation, is designed for a maximum capacity of 6,000 pairs per day, and under present operating conditions 450 male and 430 female operatives are employed. When operating at maximum capacity, this number of employees would be increased to approximately 1,200.

At the Keith company's steam plant switchboard connection is made with the system of the Edison Electric Illuminating Company of Brockton through a substation supplied by the latter. From the buses of the Keith board an 800,000-circ.mil steel armored cable 800 ft. long serves the factory, terminating at a main distributing switchboard in the basement of this shop. Energy is supplied to the factory at 600 volts, three phase, and the general scheme of electrical supply is shown in the accompanying diagram.

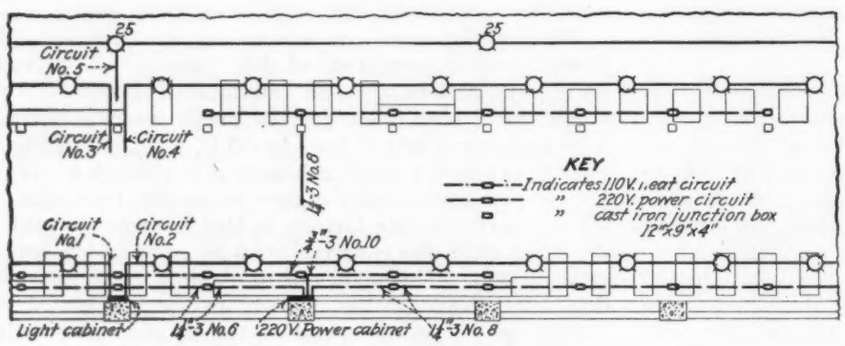
In this factory larger motors driving auxiliary equipment are supplied at 550 volts; motors used in individual driving of shoe machinery are rated at 220 volts, and lighting is at 110 volts, three phase. The lower voltage was used on the shoe machinery on account of the hazard 550 volts presents to the employees. The transformers required for 220-volt and 110-volt service are located in an inclosure in the mill yard, the primary and secondary connections being run in underground cable between the factory distributing board and the inclosure.

Distribution Panels Centralize Control

The distributing switchboard has one incoming line panel controlling the main feeder into the building and is equipped with a voltmeter, a 500-amp. oil-circuit breaker, relays and watt-hour meter connections. A second panel controls a 550-volt auxiliary power feeder supplying energy to elevators, an air compressor, exhaust fans, etc., and also controls a feeder running to the power transformer bank primary terminals. Two 300-amp. oil-circuit breakers are in service on this panel. A third panel controls a feeder running to the lighting transformer primaries and a spare circuit for future additions. The remainder of the board is made up of panels controlling the 220-volt power and 110-volt lighting internal distribution feeders. Each panel is equipped with indicating as well as recording wattmeters to facilitate checking the amount of energy used and the loads in various departments and sections of the factory.

The lighting service is distributed throughout the factory at 110 volts, three phase, each circuit being balanced equally to obtain a uniform load on each phase. The transformers for these circuits are located on a separate foundation outside the building inclosed in a safety fence so that this hazard could be eliminated from the factory. These transformers consist of three 100-kva. single-phase transformers for the 220-volt power circuit fed on the primary by three 400,000-circ.mil cables, leading to them from the factory distribution panel, and have a secondary connection to the factory cables of six 500,000-circ.mil cables connected in parallel to give the necessary capacity.

The lighting transformers consist of three 75-kva. single-phase units fed by three No. 2 primary circuits and delivering to six 400,000-circ.mil secondary circuits. All of these lines are run underground in lead-covered cable, incased in conduit.



TYPICAL LAYOUT OF POWER AND LIGHTING CONDUITS

This drawing shows control of six main lighting circuits from lighting cabinet, and two power circuits and one heating circuit from power cabinet. Main units, R.L.M. reflectors, 150-watt lamps; watchman's circuit with dual control from ends of shop, 25-watt lamps and Alba shades

The wiring distribution throughout the entire factory is of the most modern type, all wires being run in conduits. Each feeder panel in the various departments controls the circuits to the motor equipment. These circuits are carefully designed to reduce voltage drop and to make the system as flexible as possible. A series of outlet boxes is provided at intervals of 10 ft., in order that future connections may easily be made from the individual machines. Each motor feeder panel controls a separate circuit in each department and a separate meter records the amount of power fed through that respective panel. These motor feeder panels

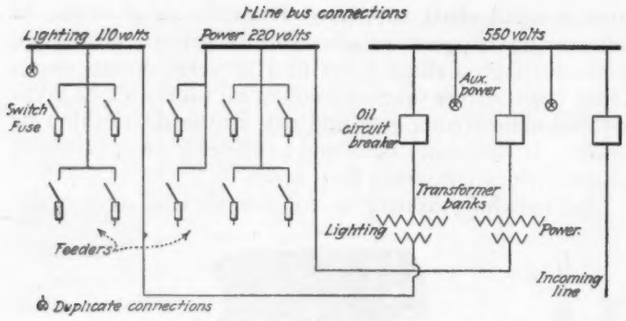
are distributed at frequent intervals throughout the factory in order that they may be accessible at all times for future extensions, and several spare circuits have been left in each.

Circuits of 550 volts were chosen for the power tables because in this case the group drive was decided upon. These power tables are short benches with six sections each, with a machine set on each individual section, driven from a small shaft supported from the table frame in ball-bearing hangers. Each table is driven by a ¾-hp. motor through a chain drive to a sprocket on the shaft. These chain drives operate in oil at all times, which gives reduced maintenance cost and ease in the distribution of power. It eliminates belts and provides a drive on short centers, which conserves floor space.

The switching apparatus for the various motors de-

Unit Drives Featured in Shoe Manufacturing

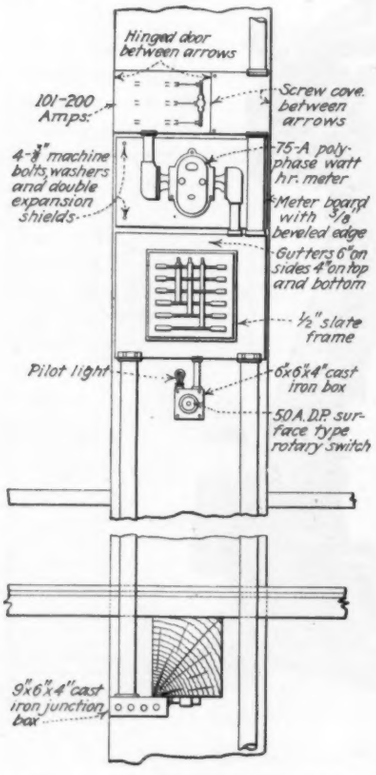
1. Motor-driven Goodyear outsole rapid lockstitch machine Belt connections are used in these units
2. Motor-driven Goodyear sole-laying machine
3. Motor-driven heel loading and attaching machine
4. Summit splitting machine, motor driven
5. Motor-driven lasting machine



SCHEME OF ENERGY SUPPLY TO FACTORY NO. 11

pends entirely upon the circuit. Individual equipment on the shoe machinery itself is controlled through a simple snap switch at the will of the operator. The power table benches are operated by an oil switch located under the bench. Each switch controls an individual motor. Care has been taken to safeguard all equipment, by thoroughly grounding the various circuits and eliminating any possibility of breakdown of the electrical distribution. Overload coils and no-voltage release attachments are provided on all motors over 7½ hp. in capacity, so that they receive adequate attention in case of interruption of service.

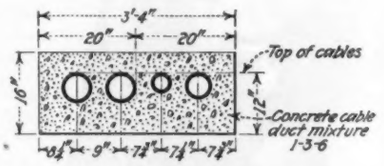
The size of the motors throughout this factory is extremely interesting, as the shoe machinery is of light construction and the rated horsepower capacity of each motor is relatively small. There are 220 motors driving individual machines with a rated capacity of 252.75 hp., bringing the average to approximately 1 hp. per machine. There are 116 fractional horsepower motors with a rated capacity of 21.69 hp. These motors run from ⅙ hp. to ½ hp. capacity and are served from both 220-volt and 110-volt circuit. There are eight motors operating for service equipment at a capacity of 152.5 hp., making a total of 344 motors with a rated capacity of 426.94 hp. The installation of individual motors on each machine makes possible the lighting distribution system which we have in this factory, as it eliminates all overhead belting, shafting, hangers, pulleys, etc., which, as any operating man knows, detract from the penetration of light to the interior of the factory. The individual drive also allowed us to place machinery in the interior of the mill, which otherwise would have been impossible. The maintenance of these motors has required considerable study, but has been worked out in a most satisfactory manner. One might ordinarily expect, with 344 motors to maintain, in addition to about 700 in other parts of these factories, that the bearings and lubrication used and motor winding breakdown would be excessive. The secret is that the motors are thoroughly cleaned and oiled at least once a week, that no motor is seriously overloaded, and that fuse conditions are so designed that adequate protection is available for all motors at each instant.


Hinged door between arrows
101-200 Amps.
Screw cove between arrows
4-⅜" machine bolts, washers and double expansion shields
75-A poly-phase watt hr. meter
Meter board with ⅝ beveled edge
Gutters 6" on sides 4" on top and bottom
½" slate frame
Pilot light
6"x6¾"x4" cast iron box
50 A. D.P. surface type rotary switch
9"x6"x4" cast iron junction box

DETAIL OF POWER CABINET, WITH SWITCH AND METER MOUNTING

In designing the power table drive, it might be interesting to know that in laying out stitching machinery of this type, we rate a motor as follows: The first horsepower will drive eight machines, and if additional machines are attached to the line, the next horsepower will drive ten sewing machines. In other words, eighteen machines require 2 hp. and each additional ten machines require 1 hp. additional.

The motor equipment for individual shoe machinery requires intensive study, as there are innumerable machines used throughout a shoe factory. The capacities of these motors run from a fractional horsepower of 0.02 to the larger sizes, which require at least 3 hp. The speeds of these motors vary, depending upon the application of the motor to the machine. Standard sizes, however, are adopted as much as possible, using 1,200 and 1,800 r.p.m. synchronous speed wherever practical.



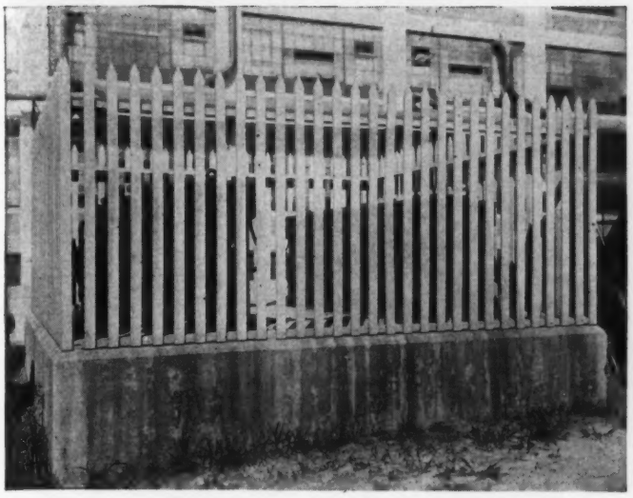
DETAIL OF CONCRETE CABLE DUCT BETWEEN TRANSFORMER BANKS AND FACTORY NO. 11

These motors are usually directly connected through a flexible coupling or by means of a chain belt or gear drive. Where the chain or gear drive is used, they are usually inclosed in a housing, which allows them to operate efficiently in a lubricating medium. The voltages vary to meet each factory condition.

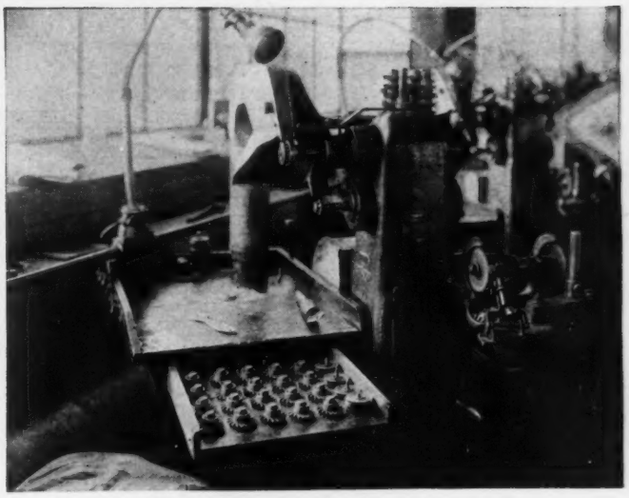
The writer would recommend, however, that 220 volts be adopted as standard for all individual motor applications, and that 110 or 220 volts be used for heating circuits. The selection of equipment in this factory naturally brought up the question of the individual as compared with the group drive. The writer made an extensive study of the qualifications of both methods and found that each problem is an individual one for decision. In order to meet this problem accurately and satisfactorily, it is necessary to lay out a factory under both methods, estimate the cost of the installation of shafting, pulleys, hangers, belting and large motors, and compare them with the wiring, switches, installation and cost for individual motors.

There are other phases, however, that must be discussed: First, the type of machine to be operated. Is it one that is under continuous power, operating the entire length of the working day without interruption, or does it have an intermediate load that requires switching from continuous to intermittent operation? Second, can the machines be grouped so that one group can be operated continuously? Are the maintenance costs of repairing large motors, belting, shafting, hangers, pulleys, etc., greater than the maintenance costs of smaller motors? The diversity factor in the operation of a group drive is also an item for consideration.

The efficiency, as regards electrical characteristics, of a series of group motors of large size driving many ma-



PROTECTIVE MOUNTING OF POWER AND LIGHTING TRANSFORMER BANKS



ADJUSTABLE LIGHTING OF EDGE-TRIMMING MACHINE BY FLEXIBLE BENCH ARM UNIT

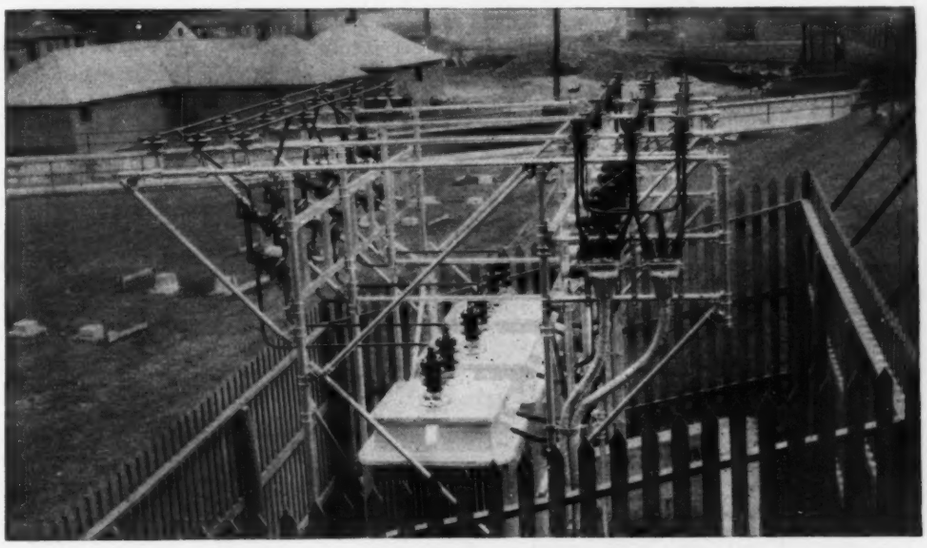
chines no doubt is considerably better than that of smaller motors. The power factor of several large motors operating at full load is also higher than that of many small motors operating under a similar condition. These items must be weighed carefully before making a decision. On the other hand, there are advantages of the individual motor over the group drive, such as flexibility of installation and the possibility of turning a machine at an angle with the line of the building so that the light may be focused directly against the point of operation, which would be impossible with the belt drive, because the machines must be either parallel or at right angles with the line shafting.

The reduction of light throughout the entire mill by the use of overhead equipment has a direct bearing on the choice of the individual motor drive. Then again, there is the matter of breakage of machine parts, which does not occur so frequently with the individual motor, especially on high-speed machinery. Should a machine break down with an individual motor, the fuse which is set exclusively for the motor capacity will blow and shut the machine down. With a belt drive, however, a large belt will frequently pull the machine over and cause additional damage. It is only by carefully weighing one condition against the other that the industrial engineer can decide which is the better method of distribution. Each problem is individual; frequently it is found in certain industries that the utility, flexibility, type of load, etc., may more than offset reduced efficiency and low power factor.

There is a solution, however, in the shoe factory, as in many other industries, for lower power factor, and that is by installing corrective apparatus, such as synchronous motors or static condensers in the line to build up power factor. One of the most satisfactory methods is to drive the large exhaust fan with a synchronous motor. The exhaust fan is a steady load and frequently represents 60 per cent of the entire load in the shoe factory because of its capacity. By installing a synchronous motor on the exhaust fan, ideal conditions are obtained for improving power-factor conditions, especially when a penalty clause may exist in the contract for purchased power. This assists in operating a privately owned generating plant by reducing copper losses and lessening the operating load on the generator.

Illumination Involves Unusual Problems

Another interesting feature of the modern factory is the lighting system. Those familiar with shoe factories appreciate its importance, but how many such plants are inadequately lighted. Many shoe factories are low studded; the ceilings are not painted white; belting, pulleys, hangers and other equipment interrupt the flow of light from the exterior. The factories are dirty and the machines are not placed in such a location as to obtain adequate light on the point of operation. All of these items were taken into consideration when designing this factory. With high headroom, white ceilings and elimination of obstruction of flow of natural light,

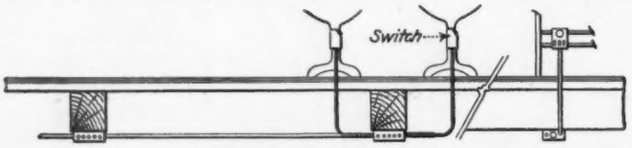


THE 900-KVA. SUBSTATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BROCKTON, WHICH SERVES THE GEORGE E. KEITH COMPANY

TYPICAL LIGHTING INSTALLATION, KEITH SHOE FACTORY; ALL OVERHEAD BELTING ELIMINATED BY MOTOR DRIVE LAYOUT

the machines were placed in such a manner that maximum intensity of light comes at the point of contact, and the overhead system of distribution was used throughout.

With 12-ft. headroom, it was possible to space R.L.M. reflectors with 100- and 150-watt units at sufficient intervals to eliminate shadows and provide adequate foot-candles at the point of operation. We eliminated all drop cords and the high maintenance cost which goes with such an equipment. This method distribution was used throughout all departments, except in those operations



METHOD OF RUNNING POWER AND HEATING CONDUIT TO MACHINES

where high intensities were required, such as hand work in the cutting department and in the fitting room on the sewing machines. Here individual lights were used throughout, but of the more modern design which employs a flexible arm supported from a bracket on the bench. These individual lights were of 10-watt capacity on the stitching machinery and 25-watt capacity in the cutting room. This gave adequate illumination, and in some cases as high as 10 or 15 foot-candles were required on the work. This may seem excessive, but where high-grade quality work is demanded, sufficient illumination is imperative.

MOTOR RATINGS FOR INDIVIDUAL SHOW MACHINERY DRIVES

George E. Keith Company Factory No. 11
(All United Shoe Machinery Company)

Machine	Motor HP.	R.P.M.
Beating and slashing—Goodyear welt	¼	1,200
Blacking—Crest heel	⅛	1,800
Buffing—Naumkeag	2	1,800
Burnishing—No. 2, Goodyear impression stitch	¼	1,800
Cementing—Model A, U. S. M. C. channel	⅛	1,200
Channeling—Goodyear Universal	½	1,750
Drier—Model A, U. S. M. C. bottom	1/20	1,800
Embossing—Model C, U. S. M. C.	⅛	1,800
Finishing—Xpedite	¾	1,800
Folding—Model A	¼	3,600
Grinder—Model D, U. S. M. C.	⅛	1,800
Grinding machine—Model M. heel trimmer knife	¾	1,800
Grooving and beveling—Model C, Goodyear welt	¾	1,800
Heel breasting—Model B, Imperial	¼	1,200
Heeling—U. S. M. C. wood	¾	1,800
Indenting and burnishing—Goodyear welt	¼	1,800
Jointing—Model D, Goodyear	1½	1,800
Lasting—Consolidated hand method	1	1,800
Lasting—Model A, U. S. M. C. staple side	1	1,800
Lasting—No. 5, U. S. M. C.	⅛	1,200
Laying—Model E, Goodyear improved sole	½	1,200
Laying—Model G, channel	½	1,200
Leveling—Acme	¾	1,800
Leveling—Goodyear welt and turn	¾	1800
Leveling—Model A, Goodyear automatic sole	2	1,800
Loading and attaching—Model B, McKay automatic heel	2	1,150
Marking—Model A, U. S. M. C.	⅛	1,800
Moulding—Model B, Goodyear twin sole	2	1,200
Nailing—American lightning	¾	1,200
Nailing—Loose	¾	1,800
Nurling—Model A	¼	1,800
Opening—Model G channel	¼	1,800
Pulling over	1	1,800
Remover—U. S. M. C. screw	⅛	1,200
Rounding—Model B, Goodyear heel seat	⅛	1,200
Scouring—Model C, heel	1	1,800
Scouring—Model N, heel breast	¾	1,800
Scouring—Model R, heel	¾	1,800
Separating—Hadaway stitch	¼	1,800
Setting and Wheeling—Model B, Goodyear edge	½	1,800
Sewing—Model K, Goodyear welt	¾	1,200
Slugging—Universal	¾	1,200
Stamping—Model C, Regent	¾	1,750
Stapling—Model B, Goodyear upper	⅛	1,200
Stitching—Model G, U. S. M. C. sole	1	1,800
Tacking—Boston	¾	1,800
Trimming—Ultima heel	3	1,800
Grinder, IHT	¼	1,800

The manner of distribution of this lighting service is unique in that it is controlled from a central feed panel on the main switchboard to distributing panels throughout each department. In this way the foreman of each room has control of his lighting system and can operate it economically. It is not subject to the whims of each individual operator. In determining the intensity of illumination required at the point of operation, tests were made in other factories and the system was designed to meet these operating conditions. The overhead system has worked out satisfactorily and has reduced maintenance costs in comparison with the use of individual drop or flexible arm units. The maintenance of this system reduces itself to cleaning reflectors and lamps, adjusting fuses and inspecting distribution panels at regular intervals or as necessity may demand.

SUMMARY OF LAMP SIZES USED IN GEORGE E. KEITH FACTORY NO. 11

Factory, Four Stories and Basement, 400 x 60 Ft.; Head Room, 12 Ft.

	Watts Rating of Lamps						
Watts rating of lamps	10	25	50	75	100	150	300
Basement (switchboard, lasts, miscel.)	0	44	141	0	69	6	0
First floor (trimming, lunch room)	0	14	26	1	24	117	0
Second floor (finishing, dressing)	0	0	22	2	39	121	0
Third floor (gang room)	0	0	32	5	0	147	0
Fourth floor (stitching, cutting)	466	136	67	3	38	38	0
Totals	466	194	288	11	170	429	0
Night lights and stairways	...	...	112	...	...	...	...
Outside lights	...	...	...	...	...	...	9
Grand totals	466	194	400	11	170	429	9

Total connected lamps inside and outside factory, 1,679.
Total connected kilowatts (lighting), 114,385.
Total connected lamps inside factory, 1,670.
Total connected kilowatts inside factory (lighting), 111.685.
Approximate connected interior lighting load in watts per square foot, average, 0.93.

ENERGY RATINGS OF ELECTRICALLY HEATED SHOE MACHINERY

George E. Keith Company Factory No. 11
(United Shoe Machinery Company)

Name of Machine Heated	Symbol	Watts
Burnishing machine—No. 2: Goodyear impression stitch	BSB–No. 2	75
Drier—Model A, U. S. M. C. bottom	UBD–A	1,525
Embossing machine—Model B	EMB	325
Finishing machine—Xpedite	XHF	600
Heater—Glue, U. S. M. C.	ZUH	300
Lockstitch machine—Model A, Goodyear outsole rapid	ROS–A	564
Marking machine—Model A, U. S. M. C.	HPM–A	...
Nurling machine—Model A	KM–A	205
Sewing machine—Model K, Goodyear welt	WTG–K	448
Stamping machine—Model C, Regent	RPS–C	325
Stitching machine—Model B, sole	SSB	63
Winding machine—Goodyear rapid bobbin	RBW	125

Industry Active in 1928

Review of business paper editors finds conditions sound. Intensive selling and lower production costs are chief factors in situation

BUSINESS is sound and 1928 will develop along the lines of 1927, when intensive selling and pressure to lower production costs were the most important factors, according to the consensus of one hundred editors of trade, industrial and professional journals in answer to a questionnaire sent to them by the National Conference of Business Paper Editors and the Associated Business Papers. There are no indications of a slump, but rather definite indications of increase in several lines. No excess inventories are reported either in wholesale or retail, except in a few specialties where the market has been over-estimated. Farm buying power will be larger in 1928.

Indexes of trade which measure week-to-week activities, such as electric power used, output of pig iron and steel ingots, building construction and freight loadings, are slightly greater than or slightly less than those of 1926. Power used in 1927 increased 7 per cent over the previous year. Pig iron totaled 36,300,000 tons, putting 1927 in eighth place among big years. Steel ingot output was about 8 per cent less for 1927 than for 1926, making 1927 fifth among years of largest output. Total construction was down, but up 2½ per cent in industrial building and 11 per cent in heavy construction.

In a review of the year the editors found increased pressure to reduce production and selling costs, higher specialization in machinery, widespread replacement of obsolete and inefficient machinery, aggressive market finding, and reduction in size and intensive development of jobbing areas. There is likewise a genuine desire to keep wages at their present level in all the basic industries, and manufacturers and merchants are seeking to continue with narrow profit margins without reducing wages or raising prices. Some trades show softening in prices, but most trends indicate prices of 1928 will be about the same as 1927. Volume of railroad freight declined, especially in the latter part of 1927, but, in common with other trades, there is expectation of an increase in freight during 1928. Gross revenue of bus lines was 25 per cent higher in 1927 than in 1926, and total pay rolls were up 30 per cent. Volume of waterborne freight was slightly greater in 1927 than in 1926, and tonnage rates held steady. In the automotive industry expenditures for new plants were larger in 1927 than in 1926, due especially to one or two very large construction enterprises and the remodelling of the Ford plant. New construction in the textile field increased, with an accompanying fact that many obsolete plants were modernized or dismantled. Rehabilitation of private power plants continued through 1927, and promises to be still more active in 1928. In general, the close of 1927 finds the industries of the United States with stocks which deviate little from the volume at the close of 1926, reflecting continued hand-to-mouth buying.

Exterior Holiday Lighting Spreads Cheer

CHRISTMAS decorations, in the form of outdoor electric lighting, have become an old story to many people in the electrical field, and the decorations probably do no more than contribute to the general community spirit of Christmas.

But Christmas decorations, like everything else, take on distinctive qualities and attract particular attention when done in an unusual way. Even the Pennsylvania Railroad puts a Christmas tree in each one of its stations, probably to show that, after all, it is run by human beings. Some utility executives believe that all central

ONE OF THE HOMES IN CLEVELAND WHICH TOOK PART IN ELECTRIC OUTDOOR DECORATION DURING THE HOLIDAY SEASON

stations should make a very marked display of Christmas decorations for very much the same reason—that the men behind the central stations are men who are active in the community and have a deep interest in the community spirit. Since decorating its buildings in this way one utility has received a number of very favorable comments and one or two letters from business men in several of the cities where its offices are located. These comments emphasize the manner in which the scheme of decorations was carried out.

A department store in Cleveland won the first prize awarded commercial buildings for holiday decoration. The exterior was draped with lighted evergreen festoons and pendants from the cornice and illuminated Christmas trees with their bases on the second floor level.

Radio Interference Interception

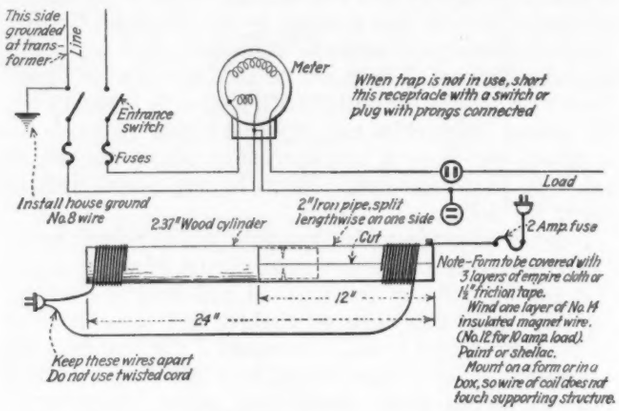
By B. E. Ellsworth
Electrical Engineer Iowa-Nebraska Light & Power Company
Lincoln, Neb.

RADIO interference can reach a radio set from the source of trouble by direct radiation (the X-ray is a good example) and over the electric service wires. To minimize that interference spread by service wires, why not put a wave trap or filter at the entrance switch? The writer has had such a wave trap in his home for more than a year and it has worked so successfully that he feels that it would be of great benefit to others. A vibrator charger can be running at "top speed" in a house next door and radio reception is not affected. No exact figures can be given on the amount of the interference that will be intercepted as it depends upon the location of the house with respect to power lines and the type of interference.

There are various makes of traps on the market selling for $10 to $20 which undoubtedly will do the work as well or better than the one utilized, if they can be secured with sufficient current-carrying capacity for the load which they will have to carry. Doubtless there are traps on the market which have been approved by the National Board of Fire Underwriters. The purpose of this article is not to recommend any type or make of trap, but to emphasis that a trap can be procured and installed to the great benefit of set owners.

The trap used can be plugged into two convenience outlets near the meter, and uses no power. The material cost is approximately $3, it can be made by the average person in a few hours. The principle of this trap was not originated by the writer, but the plug-in feature seems to be original and is convenient in that the trap may be used only when necessary and can be considered as an appliance instead of a permanent wiring fixture.

The first step is to ascertain that there is a ground on one side of the service on the line side of the entrance switch. A piece of No. 8 wire or larger may be used for this purpose. Often a ground installed in this way will eliminate considerable radio trouble from distribution lines. The sketch shows the connections and construction of the home-made trap. It is assumed that this trap is to be used in an average private home. A large trap permanently wired in and enclosed in a steel box can be used in apartment houses, etc. A receptacle should be installed in series with the non-grounded lead from the meter for plugging in the trap. It will be necessary to substitute a short-circuiting switch or shorted plug to short this receptacle when the trap is not in use. The second receptacle is simply a tap to the grounded service wire, to ground the metal pipe in the core of the coil. The leads from the coil should be separated as much as possible and double-conductor cord should not be used for this load. The coil proper is wound on a combination wood-and-iron form. The iron part of the core is composed of a two-inch pipe a foot long with a slit cut lengthwise on one side to eliminate


This side grounded at transformer
Line
Meter
When trap is not in use, short this receptacle with a switch or plug with prongs connected
Entrance switch
Fuses
Load
Install house ground No.8 wire
2.37" Wood cylinder
2" Iron pipe, split lengthwise on one side
Cut
2 Amp. fuse
Note—Form to be covered with 3 layers of empire cloth or 1½" friction tape. Wind one layer of No. 14 insulated magnet wire. (No. 12 for 10 amp. load). Paint or shellac. Mount on a form or in a box, so wire of coil does not touch supporting structure.
12"
24"
Keep these wires apart Do not use twisted cord

CONSTRUCTION AND INSTALLATION OF TRAP FOR SYSTEM-PROPAGATED RADIO INTERFERENCE

eddy currents. This form is covered with three layers of empire cloth or 1½-in. friction tape and wound full of No. 14 (No. 12 for 10-amp. load) magnet wire which should be shellacked or painted. This coil may be mounted in a wooden box.

Letters from Our Readers

Design Drawings Part of Contract Proffer

To the Editor of the Electrical World:

The reply to your question on prospective purchasers appropriating designs and design drawings without payment, in the issue of Dec. 31, may be found in the Ten Commandments. A quotation and the blueprints accompanying it are a proffer of contract which the purchaser may accept or reject, but may not change. In other words, the quotation proposes to exchange a design and material for a definite amount of money—it does not offer a free gift of either.

Just what the "good of the industry" or the overhead cost of design has to do with the honesty of a particular transaction is not altogether clear. In a so-called buyers' market, where everything seems to go—on one side—it might be well to give the other side a hearing, even though the testimony needed expurgating. For example, sending out inquiries by multigraph, hunting for a sucker, accepting a palpably erroneous bid because the seller was "responsible," whipsawing bidders to unreasonable figures, radical changes after details are completed, etc.

It is not claimed that all buyers do all or indeed any of the above, but such things are as well known among the sellers as is the identity of those who do them.

R. D. Coombs.

New York.

Digest of Electrical Literature

Transmission, Substations and Distribution

Transmission Tower Diagonal Bracing.—C. R. YOUNG, W. B. DUNBAR and E. B. ALLAN.—The authors report the results of a series of tests made at the University of Toronto in an endeavor to determine the deflections in various struts used in the fabrication of transmission towers. It was particularly desired to throw some experimental light on the effective length of bracing struts. A series of specimens were made up and tested to failure. Extensometers were atttached to the struts and furnished some of the desired information. The results, as plotted in deflection diagrams, offer a basis for comparing the value of several types of frames of different cross sections. The authors conclude that the effective or equivalent unsupported length of a strut, stayed laterally by an intersecting tension member, varies from about 73 to 117 per cent of the distance center to center of end connections. The advisability of not reducing the center-to-center length by more than 25 per cent, and preferably by not more than 20 per cent, is indicated as a result of the several tests made in the course of this investigation.—*The Canadian Engineer*, Oct. 11, 1927.

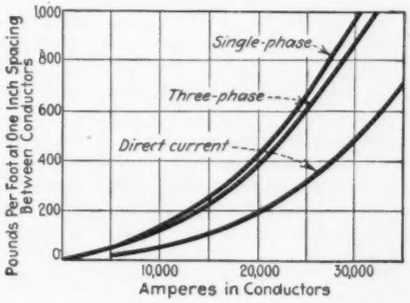
Overhead Electric Line Design.—WILLIAM T. TAYLOR.—The various factors entering into the standard for safety and construction in the design of overhead open-wire construction are reviewed in this article. A comparison of English and American practices is given, with particular consideration for the standards of loading and the development of factors of safety for overhead work. The desirable economic characteristics of wood poles and structural steel towers has been developed. The figures given refer almost exclusively to American practice.—*Electrical Review, (England)*, Nov. 11, 1927.

Generation, Control, Switching and Protection

Super-excitation.—D. M. JONES.—The speed with which the excitation of a synchronous machine can be made to counteract abnormal drops in line potential largely determines the effectiveness of the machine in increasing the stability of the system. The effectiveness of super-excitation in producing rapid changes in excitation so greatly exceeds the ordinary quick-response excitations as to be of a totally different order. In this article the author has described the newer method and has offered an approximate comparison with normal excitation, quick-response excitation and super-excitation for a 30,000-kva. 600-r.p.m., 13,800-volt, synchronous condenser. The features of this marked advance in excitation practice are stated to be the increase in the rate of rise of the exciter voltage from a basis of 400 to 600 volts per second to 6,000 to 7,000 volts per second; the rise in the maximum possible instantaneous voltage which can be applied to the alternating current machine field under conditions of system disturbance from approximately 320 volts to approximately 1,000 volts; and the use of the change in the output of the alternating current machine during the disturbance as a measure of the effectiveness of the excitation system.—*General Electric Review*, December, 1927.

Units, Measurements and Instruments

Short Circuit Effects Upon Current Transformers.—G. L. E. METZ.—The author suggests that the time has come when current transformers, like oil circuit breakers, should be designed for definite short-circuit rating, and he offers some suggestions as to how this



MECHANICAL FORCES BETWEEN CONDUCTORS

should be done. The destruction of a current transformer is said to be brought about by either the mechanical forces exerted upon the windings exceeding their disruptive limit, or by the temperature rising sufficiently to injure permanently the insulation. The design of supporting insulators and clamps must be such as to withstand the mechanical forces. The magnitude assumed between conductors spaced one inch apart is indicated in the accompanying curve. Analysis has been made of the various designs and types of current transformers available today and the author states that in the majority of modern designs, it is found that, under the most severe conditions, that is, when the magnetic core is saturated, the open-circuit secondary-induced electric-motive force rarely exceeds 400 volts. The total resistance of the circuit will be about 2 ohms, so that under no conditions is the secondary current likely to exceed about 200 amp. The accompany figure illustrates the force value between conductors.—*Electrical Review (England)*, Nov. 25, 1927.

Hydro-Electric Development and Steam Equipment

Steam Generation.—W. J. KEARTON.—The theoretical considerations, the possible thermal efficiency and the future problems related to the practical application of the binary fluid principle, as applied to steam generation, are developed. The author foresees future problems as centering around the boiler. Thermodynamic considerations, involving both assumed and derived data, are offered for the mercury-vapor steam unit. The advantages enumerated by the author include: low pressure for high temperatures, with accompanying lower working stresses in parts subjected to the pressure; the favorable physical properties of mercury for the attainment of high thermal efficiency; the few stages required when using this material, due to its high molecular weight; and the freedom from decomposition when heating. The disadvantages are stated to be high cost, small heat content and poisonous character of the metal vapor.—*World Power (England)*, December, 1927.

Continuous Combustion at High Pressure.—E. C. WADLOW.—The problems of design and operation encountered in the development of an experimental high-pressure, single-jet gas burner, and of a similar high-pressure multi-jet gas burner are described in this article. As the furnace used was an auxiliary to other apparatus and proved equal to the work demanded of it, careful tests were carried out to determine its efficiency by measuring the heat distribution through exit passes and through furnace walls after combustion. Figures and details regarding the behavior of the plant when using high-pressure combustion are given. A pressure of 100 lb. per sq.in. was realized in the combustion chamber. The maximum temperature recorded at this pressure was 1,435 deg. C. This was maintained without difficulty.—*The Engineer (England)*, Dec. 23, 1927.

Illumination

Technique of Economic Studies of Lighting in Industry.—J. W. BARKER.—The psychological and illumination questions arising in economic studies of illumination in factories have been analyzed and as a result a procedure for such investigations is suggested. This includes those factors influencing production. Emphasis is placed upon the importance of the psychological control, which is necessary if results are to be accurate. Among the factors which have been identified as affecting speed and quality of industrial production and the general welfare of industrial operatives, are the following: direct effect of illumination, to increase facility of vis-

ion; secondary effects of illumination, to increase agreeable working conditions; the effect of changed supervision, incident to the taking of data required for deriving test conclusions; the effect of conscious control of production rate; the effect of temperature, humidity, carbon dioxide, etc. in the work rooms.—*Transactions of the Illuminating Engineering Society*, 1927.

Specifications for Residential Lighting Equipment.—These specifications have been designed to promote improvement in artificial lighting in residences through the employment of lighting equipment which will render convenient and effective illumination, with conservation of eyesight and enhanced decorative qualities. A simple but highly effective device has been prepared for the estimation of comparative glare values of light sources through the use of standards employing the usual commercial lamps.—*Report, Illuminating Engineering Society*, 1927.

Light for Ornament.—A. L. Powell. —An exposition of the potentialities of light as a decorative medium. A number of uses are illustrated to indicate the interesting and attractive ways in which unusual light applications may be applied in order to secure artistic effects in the home, and in other locations where aesthetic illuminating effects are desired.—*Transactions of the Illuminating Engineering Society*, 1927.

Electrophysics, Electrochemistry and Batteries

Some Criticisms on Electric Resistance and Its Derivative.—H. Nakamoura.—The confusion between electric resistance and differential-electric resistance is pointed out. As a result of investigation and mathematical determination, the author concludes that ordinary resistance is a mere quotient of the instantaneous value of the component, which is in phase with the current of the potential difference of any two points, to the instantaneous value of the current passing through there, and has no vectorial sense. The differential resistance is, however, the first partial derivative of the former with respect to the latter and has both sense and magnitude. The Wheatstone bridge and its variations, unless balanced with a galvanometer or telephone circuit by constant equipotential, measures the differential resistance and not the ordinary one. The alternating current bridge generally measures the differential effective resistance. When the current is small or its effective resistance is non-directional, differential effective resistance numerically approaches ordinary effective resistance. —*Journal of the Franklin Institute*, December, 1927.

The Time Lag of Spark Gaps.—Y. Toriyama.—An investigation involving a new method of measurement of the spark-lag phenomena was undertaken by the author with the use of a Braun tube. The methods of test consisted in connecting the deflecting plates of the tube to a spark gap in series with them and applying an impulse voltage to the gap and to the cathode of the Braun tubes simultaneously. An absence of time lag in the gap causes the impulse voltage to be applied to the cathode and to the deflecting plates of the tube at the same time so that the electrons emitted at the cathode are deflected by the electrostatic field of the plate and no spark is indicated on the fluorescent plate. When a spark lag exists in the gap, the cathode is excited as before, but the time lag preceding the charging of the deflecting plate is indicated by a spot on the fluorescent plate of the tube. The author concludes that the time varies with the dimensions of the gap electrode, and that ultra-violet rays from a quartz lamp cause a definite reduction in the period of time-lag phenomena.—*Journal of the Institute of Electrical Engineers, (Japan)*, November, 1927.

The Relation Between the Secondary Electron Emmission from Nickel and Tungsten, and the Temperature. — Heiichi Nukiyama and Hatsuo Horikawa. — The present investigation was undertaken in an endeavor to obtain further information regarding the secondary electron emission from several metals at moderately high temperatures. Three-electrode vacuum tubes were used in this series of experiments, and the construction of the valve, the evacuation, and the wiring diagram used are described in connection with the data obtained regarding anode current and voltage characteristics, the change in the apparent secondary electron emission with anode temperature, the relation between the critical, potential and the temperature, and similar pertinent phenomena.—*Technology Report of the Tohoku Imperial University, (Japan)*, 1927.

Miscellaneous

Super-Tension Cable Drums.—The use of high-tension cables involves increased weight and length of conductor assemblies and has necessitated new practices for the successful and economical transportion of such materials to the point of utilization. A low body trailer especially designed for cable drum handling has been devised to meet the conditions involved in British practice. This equipment is said to possess the virtues of ease of operation, low labor costs, safety of operation, economy in time, and ease with which the cable may be laid directly from the trailer. Comparative figures are offered of relative transportation costs and results obtained through the use of various devices and types of transporting equipment.—*The Electrician (England)*, Oct. 7, 1927.

The Integraph Solution of Differential Equations.—V. Bush and H. L. Hazen.—The authors describe a machine which constitutes a revision of a previously constructed device for the solution of differential equations involving a single integration. The revised machine is of such design that an equation involving two successive integrations, corresponding to practically any second-order differential equation, with all terminal conditions, can be solved. The need for a workable means for solving the differential equations, involving empirical and discontinuous coefficients which occur repeatedly in electrical engineering and physics, is recalled. In the machine described, such solutions are effected by means of suitable, interlinked, integrating devices, the result being plotted continuously as a function of the independent variable. Tests and simple solutions show the over-all error to be approximately 1 or 2 per cent. The various sources of this error are discussed.—*Journal of the Franklin Institute*, November, 1927.

A New Propeller-Type, High-Speed Windmill for Electric Generation. — E. N. Fales.—It is stated by the author that a recently developed airplane-type windmill, possessing the characteristics of improved lightness, efficiency and cheapness, as well as higher rotative speed, may be manufactured to compete with gasoline farm-lighting plants. The factors considered in this discussion are the development of a rational windmill theory, the difference between pumping and electric generating mills, the aerodynamic methods of analysis, the variables used in windmill design, the form of blade, methods of regulation, wind velocity, and energy content, for a typical year, choice of wind velocity range as based upon the calmest month, choice of windmill diameter and the available energy of the wind.—*Mechanical Engineering*, December, 1927.

Inductive Signal Transmission to Trains.—P. Tatz and A. Kammerer. —A large amount of experimental research work is reported to have been done since 1919 to devise a fully reliable signal transmission system from the road to a moving train. Of the various methods tested, only the inductive method proved sufficiently promising to develop beyond the experimental stage. One section of the German Federal Railways has adopted this system as part of its standard equipment. Magnetic coupling between an alternating current excited solenoid on the locomotive and a stationary receiving solenoid, mounted on the road bed, the two forming a resonant circuit, is the basis of the system. A relay on the train is energized at all times except when passing over the signal point. To insure reliable operation, the ratio between holding and tripping force of the relay is made about three to one. A number of circuits are illustrated in this article and mathematically investigated as to their suitability for service. A second article discusses the shape of the resonance curves obtained. This system is energized by the customary small steam turbine on the locomotive which drives, in addition to the direct current lighting generator, a special alternating current generator. — *Elektrotechnische Zeitschrift*, Oct. 27, 1927.

News of the Industry

Walsh Resolution Meets Criticism

Public Service Commissioners Defend Their Course and Uphold State Regulation—Testimony from Insurance and Banking Heads—Senator Lenroot's Argument

By Paul Wooton
Washington Correspondent of Electrical World

VIGOROUS opposition to the Walsh resolution — opposition of a character calculated to impress Congress more than any that could be exerted by the utilities themselves—has come from the utilities commissioners of the states, from investment bankers and from representatives of securities owners.

When Senator Watson of Indiana called the interstate commerce committee of the Senate to order on Jan. 16 he said that the committee must consider the advisability, necessity and expense of an investigation into the conduct of public utilities of the far-reaching character indicated in the resolution which he read. Thereupon Senator Walsh made a long statement in justification of a minute inquiry by a special committee of the Senate into virtually every phase of the public utility business. He asserted in the course of his argument that "there is a view entertained by not a few people that the state commissions are not really functioning as they should because these utility corporations are constantly contributing large sums to control elections, and in one way or another they thus control state conventions."

Senator Bruce in Defense

This statement brought a vigorous rejoinder from Senator Bruce of Maryland, who said: "That is not true as far as Maryland is concerned, because our commission gives entire satisfaction to the people as well as to the utility corporations themselves." Senator Walsh is considered to have weakened his case when he said in reply: "Bear in mind that I do not undertake to assert that there is any truth whatever in the charge, but if we are going into this matter I think that should become the subject of inquiry."

Senator Wheeler of Montana, a member of the committee, asserted that he had been informed reliably that power companies desirous of competing with those affiliated with the large holding companies find the banks unwilling to finance them. Senator Walsh said that this might come within the purview of the investigation, but he evidently was not ready to emphasize that point as a member of the committee had raised the question whether the investigation was likely to lead into a probe of banking. Senator Walsh expressed the opinion that he did not think this would be the result. He also said that it was his intention in framing the resolution to exclude an inquiry into the conduct of telephone, telegraph and radio companies. He gave it as his view that those activities should be investigated but not as a part of the utilities inquiry, as such a scope would make it too broad.

Commissioners Take Stand

A committee representing the National Association of Railroad and Utilities Commissioners made a special point of Senator Walsh's statement in a report which was submitted to the committee at its subsequent session. That report follows:

The special committee representing the National Association of Railroad and Utilities Commissioners declare themselves in favor of placing at the disposal of any duly authorized agency of the Senate or of Congress any relevant information concerning public utility regulation within the possession of the several state commissions. They thoroughly believe that all facts in connection with utility operation and regulation should at all times be open to the public and its representatives. On behalf of such commissions they challenge the statement made by Senator Walsh at the hearing yesterday in which he made suggestions regarding the proper functioning of state commissions, at the same time disclaiming knowledge of any facts justifying such belief. They believe that any investigation fairly conducted cannot fail to justify the work that has been done by the state commissions and vindicate the principle of state regulation.

The commissions declare themselves opposed to invasion by the federal government in any manner of the rights of the sovereign states in the control and the regulation of public utilities. Therefore these commissions are opposed to any action of Congress that might result in an invasion of state rights or the substitution of national for state utility control.

The foregoing statement was signed by Lewis E. Gettle, chairman of the Railroad Commission of Wisconsin, chairman also of the special committee; William A. Prendergast, chairman Public Service Commission of New York; W. D. B. Ainey, chairman Public Service Commission of Pennsylvania; Charles E. Gurney, chairman Public Utilities Commission of Maine; Amos A. Betts, Arizona Corporation Commission, and H. H. Corey, Public Service Commission of Oregon.

Mr. Gettle explained that the commissions are not opposed to a federal investigation of matters included in the resolution which involve interstate commerce and interstate transactions. On that point, however, Mr. Ainey called attention to the fact that the states are co-operating very successfully in the handling of the interstate problems.

Senator Walsh places principal reliance, in justifying the authority of Congress to undertake such a probe, on the theory that the securities of utility companies and of the holding companies pass in interstate commerce. He stated that "securities of the public utility companies are advertised in great financial journals and are sold upon the Stock Exchange and pass through the mails and by express and otherwise from one state to another." He cited a number of court decisions to support his theory that the passage of securities from one state to another constitutes interstate commerce.

Mr. Gettle stated that only 9 per cent of the total production of electricity is transmitted in interstate commerce. He, too, pointed out the success in arranging between states for the regulation of rates for electricity produced in one state and consumed in another. At another point in his testimony Mr. Gettle called attention to the fact that "public utility stocks and bonds have a far more extensive and comprehensive supervision than any other class of securities issued in the United States, and that if the purpose is to have federal regulation for the protection of investors, then it would spread out into an examination of all securities."

When Senator Walsh said: "Apparently what you are afraid of is that there will be some legislation that will interfere with the rights of the states in this matter," Mr. Gettle replied vociferously, "Yes, and every type of federal regulation that we have had any experience with has resulted in increased rates and diminution of power."

Financial Chiefs Testify

Frederick H. Ecker, vice-president of the Metropolitan Life Insurance Company, pointed out that the life insurance companies number among their assets a billion dollars' worth of public utility securities. He pointed out further that the life insurance companies have in force $87,000,000,000 of insurance, which covers 62,000,000 individual lives. Because of those vast interests he urged that any investigation be one of fact finding and along the lines of a judicial inquiry. An investigation of a sensational character, he said, would have the result of depressing the values of securities and retarding the companies from securing the capital necessary for the further development of their properties.

Henry R. Hayes, president of the Investment Bankers' Association of

America, spoke along similar lines. Among other things he made the following reference to the utility industry:

The public utility industry is now in a very desirable condition of prosperity. The reason for this is because, as a whole, it is economically sound throughout. It supplies "products" the usefulness of which is constantly growing and virtually universal and unlimited. Through its technical, managerial and financial progress it has consistently effected improvements and expansion to meet, economically and efficiently, the ever-increasing demands of the public. It is ever a pioneer, going continually into new fields, even today bringing electric service to the farmer in a degree not practical a few years ago. It is a vital part of the industrial, the civic and the home life of the nation, an integral factor in the country's prosperity, its creation and distribution of new wealth.

SENATOR LENROOT'S ARGUMENT

The committee on Wednesday heard the argument of former Senator Irvine L. Lenroot, counsel for the Joint Committee of National Utility Associations. In submitting a comprehensive brief which has been prepared by leading utility lawyers throughout the country in opposition to the resolution, Senator Lenroot said that if the resolution prevailed in the Senate in its existing form, it would compel the proposed special committee to investigate not only the utility companies and the holding companies but every bank, insurance company and other corporation holding utility securities and that it would be the greatest and longest task ever undertaken, with the possible exception of the valuation of the railroads. Senator Lenroot called attention to a chart contained in the brief which showed that while all other commodities had increased in price, some as much as 120 per cent, since 1913, the average price of electrical energy had shown a decrease of 12 per cent.

Senator Walsh on Monday read into the record an interview in the Brooklyn *Eagle* with Owen D. Young, chairman of the board of the General Electric Company, in which he stated that the utilities would not oppose an investigation. Mr. Lenroot read a part of that interview in which Mr. Young declared that the utilities would not oppose an investigation by proper authorities when specific charges had been made. Mr. Lenroot insisted that no specific charges had been made against the utility companies and issued a direct challenge to Senator Walsh to show the contrary. He referred to the statement made the previous day by Chairman Gettle of the Wisconsin Utilities Commission in which he said he could not reply to rumor. "No facts have been placed in the record," Senator Lenroot said, "to show that such an investigation is needed or warranted. No prima facie case had been made out. Senator Walsh takes the position that the Senate should investigate in order to determine whether there is anything wrong." He added that the language of the resolution makes it mandatory upon the proposed special committee to investigate each and every company.

The Senate has no jurisdiction to investigate or legislate on most of the proposals contained in the resolution, Mr. Lenroot contended. Matters pertaining to interstate commerce and the violation of the existing federal statutes, however, would be proper subjects for investigation. Inviting the committee's attention to the clear line of demarcation between federal and state jurisdiction, he said that this was one of the most serious matters the interstate commerce committee ever had been called upon to consider. He asked if there was to be initiated a policy of centering in some bureau in Washington the duties belonging to the states. Another point the Senator made was that of all the corporation securities issued in the United States only 3 per cent were public utility securities and that fully 20 per cent of all securities, including the utility issues, are owned by holding companies.

Former Senator Thomas of Colorado appeared specifically on behalf of the Cities Service Company and argued along similar lines.

Owing to an important Democratic caucus, there was no session of the committee on Thursday.

Commissioners of Four States Form Association

Members of the Public Service Commissions of Pennsylvania, New York, New Jersey and Maryland in a two-day meeting at Philadelphia have just organized the Middle Atlantic States Utility Commissioners' Association. William D. B. Ainey, chairman of the Pennsylvania commission, was elected president and Commissioner J. F. Harper of Maryland was elected secretary.

A paper on valuation was read by William A. Prendergast, chairman of the New York commission, and the subject was discussed in reference to the organic law and the interpretations placed on it by state and federal courts. Chairman Ainey reviewed the development of the electrical industry and conducted a discussion of problems, including those concerned with holding companies, with consideration of the relation of the commissions to the Walsh resolution and the proceedings of the Senate committee to which it was referred.

New York Assemblyman Assails State Commission

Declaring that the New York Public Service Commission and its employees are acting in concert with private utility corporations to compel citizens to pay exorbitant costs for the use of electrical power, Assemblyman Cuvillier, a prominent New York City Democrat with independent proclivities, has introduced in the Legislature a resolution providing that the Assembly judiciary committee investigate all complaints and report back to the Legislature by March 2.

Four Large Firms Combine as Engineers and Constructors

Formation of United Engineers and Constructors, Inc., with its main office in Philadelphia and branch offices in New York, Newark, Chicago, Los Angeles, Atlanta, Pittsburgh, Houston, Montreal, Rio de Janeiro and Buenos Aires, was announced on Tuesday, Jan. 17. The company thus formed will combine the U. G. I. Contracting Company of Philadelphia, the Public Service Production Company of Newark, Dwight P. Robinson & Company, Inc., of New York and the Day & Zimmermann Engineering & Construction Company of Philadelphia. "With a background of more than 45 years of successful work," says the announcement, "the company will operate in any part of the world under broad powers permitting participation in every form of engineering and construction activity." Dwight P. Robinson, widely known as an electrical engineer, executive and plant builder, will be president of the new company. Arthur W. Thompson, Thomas N. McCarter, Samuel T. Bodine, Paul Thompson, John E. Zimmermann and Mr. Robinson will be directors. The new company is launched with contracts in hand amounting to more than $100,000,000.

N.E.L.A. Commercial Section Men Gather at Chicago

Eleven committees of the National Electric Light Association, Commercial National Section, are holding a series of meetings this week at the Edgewater Beach Hotel, Chicago. More than two hundred members had registered at the time the ELECTRICAL WORLD went to press, with Chairman J. E. Davidson presiding. The plans of the year are under discussion, with the most progressive program that has been undertaken in recent years before the gathering. The power, merchandising and wiring committees are particularly active. Detailed reports of these meetings will be published next week.

Television Demonstrated by General Electric Company

A demonstration of television was made on Friday afternoon, Jan. 13, in Schenectady under the direction of Dr. E. F. W. Alexanderson, consulting engineer of the Radio Corporation of America and the General Electric Company, who with his assistants has been working on the problems involved in this new art for seven or eight years. Receiving sets, the development of recent months, were established in three Schenectady homes, and the motion pictures were sent through the air, accompanied by vocal transmission. One "announcer" was shown smoking a cigarette and commenting on its flavor, and a ukulele player hummed a song to the accompaniment of his instrument.

The receiving sets in private homes

were at the residences of E. W. Allen, vice-president of the General Electric Company in charge of engineering; Edwin W. Rice, Jr., honorary president of the board of the company, and Dr. Alexanderson. The experiment was entirely successful, and David Sarnoff, general manager of the Radio Corporation of America, described it as an "epoch-making development." Television sets were not ready for the market, he said, but he predicted that in five years television would be "an art and an industry in this country."

California Light and Power Companies Cut Rates

Rate reductions applicable to domestic lighting, cooking and heating and commercial lighting were announced on Jan. 17 before the California Railroad Commission by attorneys for the Pacific Gas & Electric Company, Great Western Power Company, San Joaquin Light & Power Corporation and the Midland Counties Public Service Corporation. Details of the new rates and the amount of the reductions are to be announced later. It is understood that the new tariffs will be applicable about March 1.

Policy for Muscle Shoals

House Committee Adopts Five Principles to Govern Sale or Lease, Which Must Be in Entirety and Insure Fertilizer Production

SALE or lease of the Muscle Shoals project in its entirety and a requirement that fertilizer must be manufactured at prices attractive to the farmer are among the principles which will govern any disposition of the properties by the government, it was decided on Jan. 13 by the House committee on military affairs. The full text of a resolution adopted by the committee, embodying these principles, follows.

1. That the property shall at all times be subject to the absolute right and control of the government for the production of nitrates and other ammunition components of munitions of war, and that Nitrate Plant No. 2 or its equivalent, or such other nitrogen-fixation plant or plants adjacent or near thereto as may be constructed, must be kept available therefor by the purchasers, lessees or users of the property.

2. That the purchasers, lessees or users of the property shall be obligated in the strictest terms to the manufacture and offer for sale to the American public of fertilizers in times of peace, of a volume of not less than 40,000 tons annually within fifteen years of the commencement of the term of the lease, and at prices and of kinds calculated to be attractive to the farmer.

3. That any proposal for the purchase, lease or use of the Muscle Shoals property of the United States government must be for the entire property.

4. In the consideration of any offers for Muscle Shoals, that it be a prerequisite that such offer contain a stipulation that the lessee, operating agency or owner, as the case may be, be required to return to, or account for, to the government, either in cash or by way of reduction in the price of the fertilizer manufactured, the profits from the sale of power which would have been used in the manufacture of fertilizer in case there had been no discontinuance in the manufacture thereof; that the manufacture of fertilizer may be discontinued only when there shall be such excess accumulation of fertilizer stocks as shall be in excess of the reasonable or prospective demands for such fertilizer, and such manufacture shall be resumed upon reduction to a reasonable degree of such accumulated stocks.

5. That any bid must contain such forfeiture or penalty provision as will protect and safeguard the interests and the rights of the government on account of any failure of the lessee, operating agency or owner, as the case may be, to fully keep and perform its obligations and undertakings under the contract.

Truce Over Maryland Dispute Is Entered Into

The litigation between the Consolidated Gas, Electric Light & Power Company of Baltimore and the Northern Maryland Power Company for the right to serve Havre de Grace, Md., which was to have come before the Circuit Court at Elkton on Jan. 17, was postponed for 30 days, and negotiations between the two utility concerns to effect a compromise were begun. The fight between the two companies was taken to court on appeal by the Northern Maryland company from the Public Service Commission's decision last August granting the Baltimore company the right to serve Havre de Grace, despite the claim of its rival, now controlled by the Philadelphia Electric Company, that its field was being invaded. While the heads of the two utilities would not say so, local observers believe it possible that a compromise will now be effected through an exchange of territorial rights.

Prominent Engineers Sponsor Tokyo Congress

Appointed by Secretary Herbert Hoover, as honorary chairman, 78 prominent American engineers, scientists and industrial leaders have accepted membership on the American committee of the World Congress of Engineers, to be held in Tokyo in November, 1929, according to a statement just issued by Elmer A. Sperry, chairman of the National Research Council. The permanent American committee will promote the aims and purposes of the movement and arrange for attendance of American engineers at the congress. Many of its members are closely associated with the electrical industry, including Thomas A. Edison, Samuel Insull, Gerard Swope, James H. McGraw, Michael I. Pupin, Edward Dean Adams, A. W. Berresford, John J. Carty, Gano Dunn, Bancroft Gherardi, E. M. Herr, Frank B. Jewett, John W. Lieb, C. O. Mailloux, E. W. Rice, Jr., H. T. Sands, Elmer A. Sperry, L. B. Stillwell, Calvert Townley, W. E. Wickenden, F. L. Hutchinson, D. C. Jackson, A. E. Kennelly, C. C. Chesney, Robert A. Millikan, Charles F. Scott and Elihu Thomson.

Power Board Issues Wolf River Permit

Savannah and Connecticut River Projects Get Licenses — Flathead River Promoter Ready for One — Conflict Over Feather River Development.

A PRELIMINARY permit for the Wisconsin Power & Light Company, covering five sites within the Menominee Indian Reservation in Wisconsin, was authorized by the Federal Power Commission at a meeting held on Jan. 18. A license for a power site partly within the reservation was issued this company July 20, 1927. The remaining five sites, with a proposed installed capacity of 20,000 hp., have been reported on favorably by the Chief of Engineers and the Commissioner of Indian Affairs, with the understanding that the rights of navigation and the claims of the Indians for compensation are to be respected. The commission is of the opinion that the scenic features of the region, about which there has been agitation, can be safeguarded, and the permit will carry a special provision to this end.

A license was authorized for the Savannah River Electric Company of Greenwood, S. C., covering a 120,000-hp. project 220 miles above the river's mouth.

A license for the Northern Connecticut Power Company's project on the Connecticut River near Windsor Locks was granted. The installed capacity is to be 49,800 hp., and the plant will make full use of the power possibilities on the section of the river involved.

Walter H. Wheeler of Minneapolis has applied for a license covering a project on Flathead River and Flathead Lake in Montana. He proposes to develop power at five sites on Flathead River, using Flathead Lake as a reservoir. The aggregate installation at these sites would be 170,000 hp. This application conflicts with one of the Rocky Mountain Power Company.

The Pacific Gas & Electric Company has applied to the Federal Power Commission for a preliminary permit covering a project on the Middle and South Forks of Feather River near Quincy and Oroville, Calif. The application is in conflict with an outstanding preliminary permit held by the Oroville-Wyandotte Irrigation District on the South Fork. There is no conflict on the Middle Fork as the application made by Lars Jorgensen for a license on that stream has been rejected owing to the fact that he could not demonstrate where most of the power would be marketed. The Pacific Gas & Electric Company plans to construct four storage reservoirs with 252,000 acre-feet of storage on the Middle Fork. One storage reservoir of 108,000 acre-feet capacity is proposed for the South Fork. The project includes the erection of five dams. One is to be 370 ft., another 175 ft., another 108 ft., the fourth 50 ft. and the fifth 20 ft. high. There are to be eight power houses, in which it is proposed to install a total of 360,000 hp.

Purchases and Mergers

American Power & Light Seeks Control of Washington Water Power Company — An Oregon Merger Scheduled—Arizona Edison Changes Hands

EARLY acquisition by the American Power & Light Company, New York, of control of the Washington Water Power Company, Spokane, is indicated by the announcement that the company first named has offered to exchange two and two-tenths shares of its six-dollar cumulative preferred stock for each share of Washington Water Power common. The Washington Water Power Company owns and operates eight hydro-electric power plants in Washington and Idaho along the Spokane River and at Lake Chelan.

Plans for merging smaller affiliated companies with the Pacific Power & Light Company, Portland, and for refinancing the new and larger Pacific Power & Light Company, recently announced by President Guy W. Talbot, have had to be postponed because of legal details which require more time, but it is expected that the merger will be consummated about Aug. 1. The plan calls for the incorporation of a new Pacific Power & Light Company to include not only the old company but seven smaller companies acquired in recent years by its holding company, the American Power & Light Company. These companies are the Sherman Electric Company, Moro, Ore.; Enterprise Electric Company, Enterprise, Ore.; Deschutes Power & Light Company and Deschutes Ice Company, Bend, Ore.; Grangeville Electric Company, Grangeville, Idaho; Yakima Steam Heating Company, Yakima, Wash., and the Inland Power & Light Company, Portland. Excepted from the merger are two distributing systems of the Inland company in Cowlitz and Clark Counties, Wash., and Columbia County, Ore., now being operated by the Northwestern Electric Company, Portland, in which no change of status is contemplated.

The People's Light & Power Corporation of New York has bought the capital stock of the General Power & Light Company of Chicago and its subsidiaries, which are in Western states and include the Arizona Edison Company. G. L. Ohrstrom & Company will, it is reported, finance the purchase.

The Insull power-company interests are negotiating for the Utilities Power Company of Meredith, N. H.; the Franklin Electric Company and the Northfield Electric Company of New Hampshire, but no confirmation that sale has been completed had been received from Augusta up to Thursday morning.

The Southern California Edison Company has asked the Railroad Commission for authority to purchase the Ojai Power Company, which operates in Ventura County.

The Nebraska Gas & Electric Company has taken over the Holmesville (Neb.) hydro-electric plant of J. J. Steinmeyer and F. B. Ryons for $145,000.

Douglas and Breckinridge, Okla., have sold their municipally owned light plants and distribution systems to the Oklahoma Gas & Electric Company. The vote in each municipality was unanimous. Drummond may follow suit.

Sidney, Iowa, served by the Iowa Service Company, has voted by 194 to 47 against establishing a municipal plant.

The Inland Utilities Company has offered $155,000 for the New Albany (Miss.) municipal light plant, and the Council will accept the offer unless 20 per cent of the voters demand a referendum.

Voters at Raton, N. M., by a vote of 1,285 to 130, have refused to sell its municipally owned electric light plant to the North Continent Utilities Corporation of Chicago.

Some citizens of St. John, New Brunswick, want to sell the city's hydro system to the New Brunswick Power Company, a subsidiary of the Federal Light & Traction Company of New York, and a fight may ensue.

Plans of Northern Connecticut Power Foreshadowed

On receipt of the news that the Federal Power Commission has granted the Northern Connecticut Power Company the right to build a 50,000-hp. hydro-electric development on the Connecticut River at Windsor Locks, involving the construction of concrete dams on each side of Kings Island with canal improvements and a generating station south of the New York, New Haven & Hartford Railroad bridge, President Walter B. Schwabe informed a representative of the ELECTRICAL WORLD that if the grant is acceptable to the company an installation of four units, aggregating 33,000 hp., will probably be made initially, operating under a head of 30 ft. Nothing definite has been decided as to when construction will begin or how it will be financed. In round numbers the project represents an outlay of approximately $5,000,000, creating a reservoir extending up the river to Holyoke, Mass., and substantially improving navigation facilities.

New England Credit Men Hold Fruitful Session

Alexander R. McDonald of the Pettingell-Andrews Company, Boston, was elected president of the New England Section of the National Electric Credit Association and Electric Credit Club of Boston on Jan. 17, the annual meeting being held at the University Club. Charles N. Nickerson of the Milhender Electrical Supply Company was elected vice-president and Charles A. Kane secretary and treasurer. At the business session excellent addresses were made by Fred Vose, national secretary, on "Collections"; C. R. Oliver on "Taking an Order," R. A. B. Cook on "Common Law Assignments," and Benjamin A. Atherton on "Receiverships," all three speakers representing Boston firms. Arthur Black, referee in bankruptcy for Suffolk County, Massachusetts, was guest of honor at a dinner following the business session, and an attractive entertainment program was included.

Ontario Hydro to Go On

Despite Defeat at "the Soo," Commission Plans to Serve Northwestern Part of Province—Great Lakes Company's Rights on the Montreal Disputed

NOTWITHSTANDING the decision, recorded last week, of the voters of Sault Ste. Marie, Ontario, to accept the plans of the Great Lakes Power Company for additional energy, the Ontario Hydro-Electric Power Commission is going on with plans for the development of power to meet the industrial needs of the northwestern part of the province. These plans include the development of 12,000 hp. on St. Mary's River, from 125,000 hp. to 140,000 hp. on the Mississagua River and 30,000 hp. on the Montreal River, after which the commission plans to proceed to the Ottawa River to meet any demand in the north for a further supply of electrical energy. Commissioner Maguire expresses confidence that Sault Ste. Marie will regret its decision.

Premier Ferguson of Ontario has definitely declared that the Great Lakes Power Company has no power rights on the Montreal River, where the company is planning the construction of a power plant to supply Sault Ste. Marie. The Premier said: "I have made inquiries and find that there is no record of the Great Lakes Power Company having an assignment of the rights that went with the land grant to the Algoma Central Railway, and even if it had secured such an assignment, it would include no power rights."

Philadelphia Electric's New Westmoreland Substation

The Philadelphia Electric Company is placing in service a large installation to be known as the Westmoreland substation. This station will serve as a switching center for the 66-kv. system and a connecting link between this system and the 220-66-kv. step-down station at Plymouth Meeting, which, in turn, will be the focal point of the 220-kv. transmission system involving the Conowingo hydro-electric station and interconnection with the Pennsylvania Power & Light Company and the Public Service Electric & Gas Company of New Jersey.

In addition to the 66-kv. development at Westmoreland, there will be a 13.2-kv. outdoor switching station supplied through 60,000-kva. step-down transformers from the 66-kv. system and a structure housing ultimately three 30,000-kva. synchronous condensers, testing facilities, an oil room and operating headquarters. The substation initially will consist of two 100,000-kva. lines from Plymouth Meeting, two 50,000-kva. lines each to the Richmond and Schuylkill stations and two 18,750-kva. lines to 13.2-kv. step-down transformers at the nearby Hunting Park distribution substation. By the fall of 1928 the 13.2-kv. bus and two synchronous condensers will be in service.

A.I.E.E. Winter Meeting

Transatlantic Telephony to Be Demonstrated—Lectures by Norinder and Swann—Edison and Fitz Medals to Be Presented to Coolidge and Carty

SEVERAL events outside the routine technical program, excellent as the latter is, will add special interest to the midwinter convention of the American Institute of Electrical Engineers at New York on Feb. 13-17.

Telephone communication with the British Institution of Electrical Engineers, meeting simultaneously in London, will be established on Thursday morning, Feb. 16, at the telephone session, which will open with two papers on transatlantic telephony. President Bancroft Gherardi will exchange greetings with Archibald Page, president of the British society, and Dr. F. B. Jewett and Colonel T. F. Purves of the British Post Office, who were respectively in charge of the development in the United States and Great Britain of transatlantic service, will also be heard in both countries.

Dr. Harold Norinder of Upsala, Sweden, well known in this country for his studies of lightning discharges and other matters, will lecture on the cathode oscillograph on Tuesday afternoon. On the preceding evening there will be a lecture on "The Earth's Electric Charge" by Dr. W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute and a high authority on subjects pertaining to electrophysics. Two of the most highly desired rewards for engineering accomplishment will be presented on Wednesday evening, when the John Fritz medal will be presented to General John J. Carty and the Edison medal to Dr. William D. Coolidge. The presentation ceremonies will include an address by Dr. Michael I. Pupin, who will outline the achievements of Dr. Coolidge; the presentation of the Edison medal by President Gherardi and the response of the medalist; the announcement of the John Fritz medal award by Chairman J. V. W. Reynders of the board of award, an outline of the achievements of General Carty by Mr. Gherardi, the presentation of the John Fritz medal by Robert Ridgway, chairman of the board when the award was made, and the response of General Carty.

Inspection trips to plants of the metropolitan light and power companies, the studio of the National Broadcasting Company, the Electrical Testing Laboratories and the Bell Telephone Laboratories will be held, most of them on Thursday afternoon. The annual dinner-dance is scheduled for Thursday evening at the Hotel Astor, and a smoker for Tuesday evening at the same hotel. Herewith the tentative program of the technical sessions is printed. It shows among included subjects dielectrics, interconnected power-system operation (in discussion of which five prominent engineering executives will describe different practices in the five territories they represent, covering effect on plant capacity and size of generating units, economies of operation, operating features, stability and reliability, load dispatching and load control, technique of interconnection operation, and physical facts as to interstate power), insulators, magnetism, electrical machinery, communication, automatic substations, control and protective apparatus, synchronizing devices and arc welding.

Alabama Power Company Has Budget of $15,000,000

A budget for 1928 totaling approximately $15,000,000 is announced by Thomas W. Martin, president of the Alabama Power Company. The major projects included in the company's construction program are the completion of Jordan Dam on the Coosa River, with 144,000 hp.; the completion of the Upper Tallassee Dam on the Tallapoosa River, with 50,000 hp., and the beginning of the new Warrior steam plant on the Warrior River, to have an initial installation of 80,000 hp., making a total

Program of Winter Convention of the A.I.E.E.

NEW YORK, FEB. 13-17

MONDAY, FEB. 13

Morning. — Registration; committee meetings.

Afternoon.—Electrophysics and Dielectrics: "Surge Impulse Breakdown of Air," J. J. Torok, Westinghouse Electric & Manufacturing Company; "Investigation of the Influence of Internal Vacua and Ionization on the Life Duration of Paper-Insulated High-Tension Cables," Alexander Smouroff, Electrotechnical Institute of Leningrad, Russia; "Approximate Method for Solution of Electrical Networks," E. A. Guillemin, Massachusetts Institute of Technology; "The Boltzmann-Hopkins Principle of Superposition," F. D. Murnaghan, Johns Hopkins University.

Evening.—Lecture: "The Earth's Electric Charge," W. F. G. Swann, director of Bartol Research Foundation, Franklin Institute.

TUESDAY, FEB. 14

Morning.—Interconnection and Its Effect on Power Development: "Conowingo-Hydro-Electric Project of the Philadelphia Electric Company, with Particular Reference to Interconnection," W. C. L. Eglin, Philadelphia Electric Company; "Some Problems and Results from Interconnection in the Southeastern States," W. E. Mitchell, Georgia Power Company; "Some Aspects of Pacific Coast Interconnections," P. M. Downing, Pacific Gas & Electric Company; "Interconnection and Power Development in Chicago and the Middle West," H. B. Gear, Commonwealth Edison Company; discussion by Charles L. Edgar, James Lyman, A. C. Marshall, Farley Osgood, E. C. Stone, L. W. W. Morrow, W. S. Lee, C. F. Hirshfeld, G. N. Tidd, H. A. Barre and F. A. Allner.

Afternoon.—Miscellaneous Subjects: "The Saturation Permeameter," S. L. Gokhale, General Electric Company; "Manufacture and Magnetic Properties of Compressed Powdered Permalloy," W. J. Shackelton, Bell Telephone Laboratories, and I. G. Barber, Western Electric Company; "Effect of Humidity on Dry Flashover Potential of Pin-Type Insulators," J. T. Littleton, Jr., and W. W. Shaver, Corning Glass Works; "The Cathode Oscillograph as Used in the Study of Lightning and Other Surges on Transmission Lines," lecture by Harold Norinder.

WEDNESDAY, FEB. 15

Morning. — Electrical Machinery: "Synchronous Machines—IV," R. E. Doherty and C. A. Nickle, General Electric Company; "Calculation of Armature Reactance of Synchronous Machines," P. L. Alger, General Electric Company; "Reactances of Synchronous Machines," R. H. Park and B. L. Robertson, General Electric Company; "The Thermal Volume Meter," C. J. Fechheimer and G. W. Penney, Westinghouse Electric & Manufacturing Company.

Afternoon. — Electrical Machinery (continued): "Recent Improvements in Turbine Generators," S. L. Henderson and C. R. Soderberg, Westinghouse Electric & Manufacturing Company; "Design and Application of Two-Pole Synchronous Motors," D. W. McLenegan and I. H. Summers, General Electric Company; "Heat Losses in the Conductors of a Direct-Current Armature," W. V. Lyon, E. Wayne and M. L. Henderson, Massachusetts Institute of Technology; "Effect of Transit Conditions on Application of Direct-Current Compound Motors," L. R. Ludwig, Westinghouse Electric & Manufacturing Company.

THURSDAY, FEB. 16

Morning.—Communication: "Transatlantic Telephony — The Technical Problem," O. B. Blackwell, American Telephone & Telegraph Company; "Transatlantic Telephony—The Operating Problem," K. W. Waterson, American Telephone & Telegraph Company; "A New Horn-Type Loud Speaker," C. R. Hanna, Westinghouse Electric & Manufacturing Company; "Certain Topics in Telegraph Transmission Theory," H. B. Nyquist, American Telephone & Telegraph Company.

FRIDAY, FEB. 17

Morning. — Control and Protective Equipment and Substations: "Automatic Control of Edison Systems," O. J. Rotty, United Electric Light & Power Company, and E. L. Hough, General Electric Company; "Protection of Supervisory Control Lines Against Overvoltage," Edward Beck, Westinghouse Electric & Manufacturing Company; "1926 Lightning Experience on 132-Kv. Transmission Lines," Philip Sporn, American Gas & Electric Company; "Vacuum-Tube Synchronizing Equipment," T. A. E. Belt, General Electric Company; "Use of Condenser-Type Bushing in Synchronizing," E. E. Spracklen, Ohio Public Service Company, and D. E. Marshall and P. O. Langguth, Westinghouse Electric & Manufacturing Company.

Afternoon.—Arc Welding: "Effects of Surface Materials on Metallic Arc-Welding Electrodes," J. B. Green, Fusion Welding Corporation; "Arc Welding—Influence of Surrounding Atmosphere on the Arc," P. Alexander, General Electric Company; "Arc-Welded Structures and Bridges," A. M. Candy, Westinghouse Electric & Manufacturing Company; "Welding and Manufacture of Large Electrical Apparatus," A. P. Wood, General Electric Company.

of 274,000 hp. additional in hydro and steam plants to be in operation by the end of 1928.

Other items will include the addition of 100,000 hp. in step-down primary substations, 200 miles of 154-kv. and 110-kv. transmission lines, 200 miles of low-tension transmission lines and 500 miles of distribution lines.

Georgia Power Company Will Spend $12,750,000

The Georgia Power Company plans to spend approximately $12,750,000 in Georgia during 1928 — probably the largest expenditure for enlargement and improvement in service ever made in any one year by a Georgia public service company. While the sum named includes street railway and gas expenditures, the bulk of it is for the electric department. The program will provide an additional water-power plant, extension of transmission lines and distribution systems into new territory, wide improvements in street railway and gas service.

Among the major projects planned are a transmission line between Louisville and Waynesboro and one connecting Vidalia, Mount Vernon, Glenwood and McRae; the enlargement of the Boulevard substation in Atlanta and of the substation at Marietta, as well as the construction of several substations and other improvements in Macon, Athens, Rome, Brunswick and elsewhere.

The year 1927 brought the construction of the Burton power plant, completing developments on the Tallulah and Tugalo Rivers; the start of a new 110,000-volt line from Atlanta to the Martin's Dam plant of the Alabama Power Company, the completion of many local lines, and the establishment of 22 retail stores in as many communities.

Los Angeles Bureau Forbidden to Erect Tideland Plant

Upholding the temporary injunction issued some months ago restraining the Bureau of Power and Light of Los Angeles from constructing a steam-electric power plant on the harbor lands of the city, the Superior Court of Los Angeles County on Jan. 9 made the injunction permanent. This is looked upon as a victory for the Southern California Edison Company, which had brought suit as a taxpayer in the city asking that this injunction be granted. In rendering the decision the court held that the money which had been illegally transferred from the bond fund of the city into the power revenue fund by the Power Bureau must be returned.

The city, apparently anticipating the decision of the court, has acquired another site, and it is understood that the project of a steam standby plant has not been abandoned by it, the court having sustained its right to invest portions of its revenue in such power stations.

Many Topics Interest Men of Empire State

Financial and economic problems of the electric light and power industry as related to other enterprises were dealt with by H. O. Palmer, president of the Empire State Gas and Electric Association, at the annual meeting of its Electric Section, held at Hotel Niagara, Niagara Falls, N. Y., on Jan. 12 and 13. Water power had a prominent part on the program, the address of Paul S. Clapp, managing director of the National Electric Light Association, on that subject and the fallacies that the public entertain regarding it being heard with much interest.

The report of the apparatus committee, presented by V. J. F. Brain, covered the developments and recent applications of metal-clad switchgear with particular reference to the practices followed by the New York Edison Company. Representatives of the Allis-Chalmers, General Electric and Westinghouse companies discussed the progress of their respective organizations in this field. W. C. Fisher, chairman of the section, pointed out that while the advantages appeared to have been definitely proved, the cost item constitutes the most important deciding factor of use.

Load forecasting, network problems, material specifications, distribution records and desirable voltage practices were discussed by O. G. Whitecotton, chairman, and by sub-chairmen of the overhead distribution committee; various operating problems, design improvements and developments in tools and equipment were considered by T. R. Eilenberg in his report as chairman of the underground systems committee; ice troubles in hydro-electric practice and practical methods of combating them were canvassed by B. E. White of the hydraulic power committee; laboratory data related to lightning phenomena and flashovers were summarized and co-ordinated by W. L. Lloyd of the General Electric Company, speaking on the report of the transmission-line committee, of which S. H. Abbey was chairman, and the operating committee, under W. H. Kiefer, reported upon the condition of insulating oils. The radio co-ordinating committee, under H. F. Bower, also reported.

Paul A. Schoellkopf, president of the Niagara Falls Power Company, delivered the address of welcome. N. R. Gibson and W. K. Bradbury of that company outlined plans for the ultimate development of Niagara Falls and the preservation of its natural beauty. At the dinner and meeting of the Niagara Frontier Section of the American Institute of Electrical Engineers, on Jan. 13, to which members of the association were invited, Prof. Vladimir Karapetoff of Cornell University spoke of "Transients in Time and Space."

A. R. Tremaine of the Associated Gas & Electric Company, Oneonta, and V. J. F. Brain of the New York Edison Company were elected chairman and vice-chairman respectively.

Briefer News

ELECTRICAL LEAGUE OF COLORADO ELECTS OFFICERS.—B. J. Rowan, executive assistant to the district manager of the General Electric Company at Denver, has just been elected chairman of the Electrical League of Colorado. E. C. Headrick and Dean D. Clark were re-elected secretary and treasurer respectively.

GATINEAU POWER TO COST ONTARIO CITY $8 A HORSEPOWER MORE THAN REGULAR SUPPLY.—The Ontario Hydro-Electric Power Commission has agreed to supply the city of Kingston with all the extra power it needs for the next eight years at $36 per horsepower. The present agreement between the city and the commission still has eight years to run and provides for the supply of power at $24 per horsepower. The new power to be supplied is part of the block which the commission has purchased from the Gatineau Power Company.

ELECTRICAL COMMITTEE OF N.F.P.A. WILL MEET FEB. 14.—The annual meeting of the electrical committee of the National Fire Protection Association will be held in the auditorium of the Consolidated Gas Company, New York, beginning at 9.30 a.m., Tuesday, Feb. 14, and adjourning on Friday of that week. E. Donald Tolles, executive secretary of the Electrical Supply Jobbers' Association, has been named as the representative of that body in succession to Thomas J. Creaghead.

IOWA SECTION, N. E. L. A., WILL HAVE GOOD PROGRAM. — Commercial men and "distribution men" will share the program of the Iowa Section, N.E.L.A., which will meet at Cedar Rapids on Feb. 2 and 3. Lighting, "refixturing," lamp sales, refrigeration, range sales, farm equipment, advertising helps, sales organization set-ups and laundry equipment will be commercial session topics, while the operating men will discuss farm service, transformer equipment, transmission and its regulation, inductive co-ordination, accidents, radio and metering. At the general opening session President C. S. Macy, S. C. Dows, Paul S. Clapp and C. A. Leland will be heard.

SACANDAGA DAM CONTRACT LET.—A contract for the nine-million-dollar Sacandaga dam, by which a body of water with an area as large as Lake George will be impounded in the Sacandaga River Valley at Conklingville, N. Y., to improve the river flow and provide power for industrial purposes, has entered its final stages by the letting of the contract for the construction of the dam to S. J. Groves & Son of Minneapolis for $1,307,086 by the Hudson River Regulating Board. The dam will be 1,000 ft. long, with a spillway 300 ft. long, and 85 ft. high. The contract calls for its completion by Dec. 31. Of

the assessment 95 per cent will be paid by the power companies deriving benefit and 5 per cent by the cities of Albany, Troy, Watervliet and Rensselaer, which receive flood protection.

JOLIET, ILL., WILL HAVE NEW UTILITY BUILDING. — The Public Service Company of Northern Illinois announces that work will begin in April upon a four-story unit of a proposed ten-story tower building at Ottawa and Cass Streets, Joliet, to provide office and sales department space. The unit will cost approximately $400,000, and the completed building will represent an investment of $1,000,000. The company hopes to have the unit completed within a year.

DUQUESNE LIGHT COMPANY TO CUT RATES ON FEB. 1.—Residential wholesale and retail consumers of electrical energy furnished by the Duquesne Light Company, Pittsburgh, will pay after Feb. 1 $700,000, or 3 per cent, less annually for the same service as formerly, according to an announcement by President A. W. Robertson. The revised code, Mr. Robertson said, is made possible by the great increase in the consumption of electrical energy and by economies in operation. It eliminates the necessity of checking the number of outlets or rooms in homes of seven rooms or less.

DOUBLE INDUSTRIAL HYDRO UNIT AT FULTON, N. Y., WILL HAVE RATING OF 100,000 HP.—A large hydro-electric development on the Oswego River in New York State will be completed early this year with the linking into one unit of the power plants on both banks of the river at the upper falls dam at Fulton, N. Y. This plant, which is owned by the Oswego Falls Paper & Pulp Company, is planned to develop about 100,000 hp. from an 18-ft. head. It was made possible by the purchase two years ago of the American Woolen Mills power plant at the west end of the dam, which when completed will operate in unison with the Oswego Falls plant.

SUPPLEMENTING NEW HAMPSHIRE HYDRO POWER WITH STEAM.—The 14,000-hp. steam boiler installed by the Public Service Company of New Hampshire at Kelley's Falls in 1927 has given this station capacity to carry the electric load for Manchester, Keene, Nashua and Dover. Water power from the Piscataquog River is sufficient to operate the hydro plant at Kelley's Falls only three months of the year, but the steam installation will make it possible to provide the necessary power during the rest of the year. The Twin State Gas & Electric Company, Dover, N. H., is getting a good portion of its energy from the Kelley's Falls plant.

CONFERENCE OF UTILITY ASSOCIATION SECRETARIES OUTLINES PURPOSES.—At the National Conference of Utility Association Secretaries held recently at Oklahoma City the organization, which has been functioning informally for about five years, adopted the name just given and issued the following statement of its objectives: "To study the possibilities, economy and effectiveness of service to the utility industry realized through its established associations; to disseminate those ideas of organization and administration of association affairs which have been proved of merit, and to promote a spirit of unity of purpose and co-operation of effort among the various state, regional and national utility associations."

OREGON'S NEW LAW REGULATING PERMITS FOR HYDRO-ELECTRIC DEVELOPMENTS.—According to the Oregon State Engineer, intended results are now being obtained from the passage in 1927 of an act which provides for prohibition of filings on water resources of the state for purely speculative purposes. The new law, which limits passive applications to a six-month period, has brought about the cancellation of several preliminary permits for the development of electric power, among them one involving Marion Lake. The water rights of this project are still in the hands of the original filer, however, owing to his immediate action in filing preliminary papers with the Federal Power Commission.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 23-27. S. N. Clarkson, 420 Lexington Ave., New York.

New England Central Station Association of Power Engineers—Chamber of Commerce, Boston, Jan. 25. T. D. Bond, C. H. Tenney & Co., Boston.

Artistic Lighting Equipment Association—Winton Hotel, Cleveland, Jan. 25-28. G. P. Rogers, 711 Graybar Bldg., New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

Iowa Section, N.E.L.A.—Roosevelt Hotel, Cedar Rapids, Feb. 2 and 3. H. E. Weeks, Davenport, Iowa.

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16; St. Louis regional meeting, March 7-9. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

Oklahoma Utilities Association—Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

AMERICAN ENGINEERING COUNCIL OFFICERS. — Besides the election of A. W. Berresford as president, noted last week, the following vice-presidents were chosen by the American Engineering Council at Washington: L. P. Alford, New York; O. H. Koch, Dallas; I. E. Moultrop, Boston, and G. S. Williams, Ann Arbor, Mich. John H. Finney, M. M. Fowler, H. A. Kidder, Farley Osgood, C. F. Scott and C. E. Skinner will represent the A.I.E.E. on the administrative board, and Alex Dow heads the representation from the A.S.M.E.

CARRYING 110-KV. LINE ACROSS THE CONNECTICUT RIVER.—The first span of the New England Power Company's 60-mile, 110,000-volt transmission line from the Bellows Falls (Vt.) plant to Pratt Junction, Mass., is yet to be strung. This span crosses the Connecticut River and involves an engineering problem because of its extreme length. The wires will reach the first steel tower high up on Mount Kilburn on the New Hampshire side, a span of 2,080 ft. The entire line requires 375 67-ft. towers and the average span is 843 ft.

FIRST ELECTRICALLY PROPELLED PACKETBOAT.—Another field for electric ship propulsion will be opened with the completion of an electrically propelled packetboat now being built for the Middlesex Transportation Company of New Brunswick, N. J. This boat will have a capacity of 250 tons of package freight and will operate at a speed of 12 miles per hour. It will run between New Brunswick and New York City and will supplement an extensive trucking business carried on by the owners. Electric equipment will be supplied by the General Electric Company.

NEBRASKA FARMERS DROP CO-OPERATIVE PLAN FOR PRIVATE SERVICE.—The Sunflower Farmers' Electric Light District in Nebraska, recently organized by land owners in the North Platte Valley for the purpose of issuing bonds and using the proceeds to build a distribution system for electrical energy to be purchased from the government development at Lingle, has been dissolved. Manager McFadden of the Western Public Service Company, which has lines through that section, offered to furnish the farmers with energy at stipulated rates, based on use, over the company's system, and this offer proved more attractive. The company agreed that for a bonus of $200 from each of at least 22 land owners it would build and operate the system and charge approximately town rates.

PROGRESS IN KENTUCKY IN 1927.—In 1927, L. B. Herrington, president Kentucky Utilities Company, reports, that company built 30 miles of 66,000-volt, 97 miles of 33,000-volt and 48 miles of lower-voltage lines. A hydro-electric plant is under construction at Lock No. 7 on the Kentucky River and will be completed next summer. The company has also completed more than half of a

double-circuit steel-tower line of 66,000-volt capacity, 36 miles long, between Morganfield and Earlington. When ready for operation, some time in March, this line will have cost approximately $280,000.——T. B. Wilson, vice-president Louisville Gas & Electric Company, says that the early opening of the company's hydro-electric plant at the Falls of the Ohio will be the biggest event on its 1928 program. Operation of the project will mean that Louisville will have available year-round navigation upstream as far as Pittsburgh, for the government's two-and-a-half-million-dollar dam was linked with the hydro project.

POWER COMPANY AND SKAGIT MUNICIPAL SYSTEM MAY BE CONNECTED.—The Great Northern Power Company, which is developing hydro-electric power on the Wallace, Olney and Sultan Rivers in Snohomish County, Wash., has asked the Seattle City Council to consider interconnection between the company's line and the city's Skagit system, and the city will consider the proposal. The Great Northern Company has acquired water and land rights in Snohomish County and within the next 60 days expects to have a 2,000-kw. plant ready on the Lower Olney River. This will be enlarged to a 42,000-kw. installation, and ultimately the company hopes to develop 120,000 kw.

METALINE FALLS PROJECT STRIKES A SNAG.—The State of Washington cannot issue a permit for the development of hydro-electric power with restrictive qualifications, as requested by Hugh L. Cooper in applying for the right to develop a site at Metaline Falls, "Z" Canyon, in northeastern Washington, Assistant Attorney-General B. B. Adams has ruled. (See ELECTRICAL WORLD for Jan. 7, page 71). The application, made for the Pend Oreille Lead & Zinc Company of Spokane, was for 7,000 sec.-ft. of water in the Clark's Fork branch of the Columbia River, with a provision that an additional 1,500 sec.-ft. might be used for 50 years and then become permanently available if not needed by the Columbia Basin irrigation project.

NEW PLANT FOR WEST TEXAS UTILITIES.—Construction will soon begin on a West Texas Utilities Company power plant which, when completed with its full complement of three units, will cost more than $5,000,000. The plant will be built on Lake Pauline, 5 miles southeast of Quanah. The first unit will have a capacity of 20,000 hp., and when the plant is completed there will be a capacity of 60,000 hp. To the company's San Angelo plant a 9,000-hp. unit is being added. These, together with the 40,000 hp. now installed, will give a total rating of 109,000 hp. Four transmission lines will leave the plant. One of these will connect with the transmission line leading through Crowell to the central system of the West Texas Utilities Company. One will lead to Quanah, one to Childress and the fourth to Vernon, permitting interconnections with the Texas Electric Service Company at Wichita Falls and the Southwestern Light & Power Company at Lawton, Okla. The West Texas Utilities came into existence less than seven years ago at Abilene, Tex.

EXPANSION AT ASHEVILLE, N. C.—The Carolina Power & Light Company will spend about $400,000 in Asheville, N. C., and vicinity for improvements and expansions in 1928, according to C. S. Walters, general manager of the company. This work does not include the large hydro-electric power plant which is being developed on the Pigeon River near Waterville, 50 miles west of Asheville, and is scheduled for completion in 1930 at a cost of $11,000,000, of which about $3,000,000 has already been spent. The appropriations for 1928 include $200,000 for transmission-line extensions and an equal amount for other equipment and for substations.

Commission Rulings

RAILWAYS NOT ELECTRICAL CORPORATIONS.—A complaint by the receiver of the Second Avenue Railroad Company in the city of New York with reference to rates for electricity charged by the Interborough Rapid Transit Company and the New York Railways Corporation has been dismissed by the New York Public Service Commission for lack of jurisdiction. The commission held that the transit companies furnishing electricity to the Second Avenue Railroad Company were not electrical corporations within the meaning of the New York statutes, although they sold part of their surplus power to electric railways. The commission said that in respect of the furnishing of electric service these corporations lacked the usual attributes of public service corporations and were not subject to the usual obligations of public service corporations; that it was not pretended that these corporations held themselves out as purveyors of electricity generally, or that they could be compelled to furnish electricity to the public generally, or that if they were to cut off service they could be compelled to restore it.

IRRIGATION COMPANY ORDERED TO MAKE SURVEY FOR POSSIBLE POWER PLANT ON SITE CONTROLLED BY IT. — In a ruling affecting the Public Water Company, which irrigates land in the Rogue River Valley, the Oregon Public Service Commission said: "Our engineers have made an examination of the utility property and have called the management's attention to the existence of certain potential water power at what is known as Bradshaw's Drop. It is the duty of the utility, in equity to its consumers, to expend every endeavor to increase its revenues wherever possible. Apparently no effort has been made to develop or dispose of this power, which in our opinion would be a source of considerable revenue. Obviously, good business management would have required this to be done long before. The utility will be required to make a survey of the possible development and disposal of this power and file a report within 90 days."

Recent Court Decisions

FRANCHISE RIGHTS UNIMPAIRED WHERE CITY REFRAINED FROM ENFORCING TAX PROVISIONS.—In an injunction proceeding by the Fort Worth Gas Company against a rival utility the Court of Civil Appeals of Texas held that the defendant's franchise rights were not impaired by the fact that the city had never enforced a forfeiture of franchise because of the rival company's failure to pay a tax on its gross earnings as required under the ordinance and had in lieu thereof assessed an ad valorem tax, nor by the further fact that the franchise had not been authorized by the voters in accordance with a provision in the city charter, since the company's state charter did not require any consent beyond that of the governing body of the city. (299 S.W. 705.)*

INTERPRETATION OF PENNSYLVANIA STATUTE PERMITTING BOROUGH TO PURCHASE ELECTRIC UTILITY. — The statutes of Pennsylvania provide that a borough may purchase the works of any company furnishing electric light to it or the public at such price as may be agreed upon by the borough and the majority in value of the stockholders of such corporation, and that upon failure so to agree the borough may present a petition to the Court of Common Pleas asking for the appointment of viewers to assess the value of the plant and works so taken. The borough of Brookville attempted to condemn and appropriate the property and franchises of the Solar Electric Company. On appeal by the company from an order of the Court of Common Pleas dismissing its exceptions to the report of viewers, the Pennsylvania Supreme Court held that the statute did not directly or by necessary implication confer power to condemn and appropriate said electric light works, but was confined to the purchase of the works when there was a willingness to sell or authority to fix a price where this was in dispute. (138 At. 845.)

TELEPHONE COMPANY WINS IMPORTANT WIRING CASE.—A decision has just been made by the Massachusetts Supreme Court in favor of the New England Telephone & Telegraph Company and against the Massachusetts Department of Public Utilities and the Hotels Statler, Inc., in connection with the right of the company to insist on the wiring of telephone installations by telephone employees. The commission had ordered the company to provide service in the Statler Building over wires pulled through interior conduits by union workmen not employed by it. While complying with this order, the company maintained that its responsibility for its service and agreement with its own forces, not affiliated with the union organization, justified it in refusing to supply service over wires not pulled by its own employees, and also that the order of the commission was an interference with interstate commerce. The court coincided with this view and said that the order of the commission requires the company to become the owner of property which later it may be obliged to reject because incompatible with the service it undertakes to give.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

W. J. Canada Joins N.E.M.A.

W. J. Canada, who has served for the last few years as electrical field secretary of the National Fire Protection Association, has resigned to join the National Electrical Manufacturers' Association with headquarters in New York. Mr. Canada has been prominent in electrical circles for many years.

Following graduation from Sheffield Scientific School at Yale, he entered the testing department of the General Electric Company, but subsequently affiliated himself with the Ohio Electric Railway Company. Later in his career Mr. Canada took up safety work as electrical engineer of the Rocky Mountain Fire Underwriters' Association, resigning in 1913 to become associate physicist for the Bureau of Standards, Department of Commerce, where he made a special study of electrical life hazard. Subsequent connections followed with the American International Shipbuilding Corporation of Philadelphia and Stone & Webster before he became head of the engineering department of the National Electric Light Association in New York. In this connection Mr. Canada paid particular attention to questions of inductive interference, insurance, the safety code and work with special technical committees of the association. In his new position Mr. Canada will correlate and direct general engineering matters.

JOHN M. COSTELLO has been appointed executive manager of the new Niagara, Lockport & Ontario Power Company, recently formed through the merger of the old Niagara, Lockport & Ontario Power Company and the Western New York Utilities Company, with headquarters in Batavia. Mr. Costello was identified with the old Niagara, Lockport & Ontario organization for sixteen years, having entered its employ in 1911 in the stores department.

OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, was elected chairman of the Economic Foundation, succeeding Thomas W. Lamont, whose term as a member of the board of trustees has expired. The Economic Foundation is a trust established in 1923 to administer funds given or to be given for investigations in the field of economic, social and industrial science.

P. C. BROOKS was elected a vice-president of Fairbanks, Morse & Company at a recent meeting of the board of directors. During a connection of 29 years with the organization, Mr. Brooks has held many positions of responsibility, and, in addition to his present office, he is president of E. & T. Fairbanks & Company, the scale manufacturing subsidiary of Fairbanks, Morse & Company. He is also vice-president of the Canadian Fairbanks-Morse Company, Ltd.

J. C. Guild New Manager of Tennessee Utility

Jo Conn Guild, Jr., who has been named general manager of the Tennessee Electric Power Company to succeed the late B. C. Edgar, as announced in the Jan. 7 issue of the ELECTRICAL WORLD, is widely known in Nashville, Chattanooga and throughout the state and his appointment was no surprise to those who had followed his career in the public utility field. Upon leaving Vanderbilt University in 1908, Mr. Guild immediately engaged in construc-

J. C. GUILD

tion work at the Hales Bar power plant, one of the outstanding engineering achievements of its character in the South at that time.

Immediately thereafter, in 1913, Mr. Guild entered the employ of the Chattanooga & Tennessee River Power Company in Chattanooga in new-business development work, with special attention to the sale of electric power to the new and expanding industries in his home city. In 1915 he was made general manager of the company. In 1922 the Chattanooga & Tennessee River Power Company was consolidated with the Chattanooga Railway & Light Company and Tennessee Power Company into the Tennessee Electric Power Company, Mr. Guild becoming vice-president of the combined companies.

His contacts with the public in general early made Mr. Guild a firm believer in the policy of maintaining good public relations between the power company and the customers it serves. He frankly advocated the widest possible dissemination of information regarding the affairs, policies and progress of the Tennessee Electric Power Company through the press. The new executive has been closely associated with the late Mr. Edgar in all of the operating problems and policies of the company and is considered fully qualified by experience, ability and training to take over the managerial reins.

MATTHEW S. SLOAN, president of the Brooklyn Edison Company, addressed a group of bankers in Philadelphia on Wednesday, Jan. 18, and another group of bankers on Thursday, Jan. 19, in Pittsburgh. Taking as his subject the national legislative problems confronting the electrical industry in Washington, Mr. Sloan referred to the Walsh investigation, the Boulder Dam bill and the Muscle Shoals situation.

S. FRED SMITH, for 36 years manager of the Salem (Mass.) Electric Lighting Company, has been appointed vice-president of that utility. Mr. Smith is a past president of the New England Division of the National Electric Light Association and is one of the most widely known managers of properties in the Tenney group. John L. Tudbury, manager of the Salem Gas Light Company, a recent addition to the Tenney list, has been made manager of the Salem Electric Lighting Company. He will remain manager of the gas company.

S. McN. JOHNSTON has resigned his position as vice-president and general manager of the Pittsburgh Transformer Company. The illness of one of his children necessitated his residing in Phoenix, Ariz., temporarily and Mr. Johnston decided with regret to sever his connections with the electrical industry for a period in order to devote his efforts to his family. His many friends will regret his absence and hope the early recovery of his child will bring him back to electrical affairs. Mr. Johnston has been affiliated with the Pittsburgh Transformer Company for ten years and was a part owner until that company was purchased by the Allis-Chalmers Manufacturing Company in May, 1927.

H. HOBART PORTER, president of the American Water Works & Electric Company, sailed Jan. 14 on the *Laconia* for a three-month cruise to South Africa. The tour, which will take Mr. Porter through the hunting country of South Africa northward to Cairo, is purely a pleasure trip.

M. L. HIBBARD, who has been chief operating engineer of the Northern States Power Company for more than four years, has severed his connection with the Byllesby organization to affiliate himself with the Electric Bond & Share Company, New York. Though a Canadian by birth, Mr. Hibbard has spent the major portion of his engineering career in the United States. Following graduation from McGill University, he entered the test course of the General Electric Company at Pittsfield,

Mass., but later returned to Montreal as an employee of the Montreal Street Railway. After engaging in consulting and construction work, he became superintendent of electric distribution for the Union Light, Heat & Power Company, Fargo, N. D., and after a period of four years removed to San Antonio as electrical engineer for the San Antonio Traction Company and the San Antonio Gas & Electric Company. He became identified with the Byllesby interests in 1911, when H. M. Byllesby & Company took over the Union Light, Heat & Power Company, to which he returned as general manager.

Obituary

WILLIAM SCHWANHAUSSER, chief engineer of the Worthington Pump & Machinery Corporation, died Jan. 15 in Peck Memorial Hospital, Brooklyn, N. Y., after an extended illness. A native of Bavaria and a graduate of the Polytechnic Institute in Mittweida, Saxony, he entered the employ of Osterheld & Eichmeyer, Yonkers, N. Y., after removing to this country, assisting in the development of engines, pumps, motors and other machinery. It was in 1885 that he took charge of the making of trade pumps for the Worthington works, then in Brooklyn. In the course of this association he introduced successfully the Worthington products in Europe, and in 1895 he was selected to direct the company's plant in Germany. Mr. Schwanhausser was 73 years of age.

HENRY T. WINCHESTER, electrical engineer, died suddenly Dec. 30 as the result of injuries sustained in an automobile accident near Detroit. A native of Boston and a graduate of the Massachusetts Institute of Technology, Mr. Winchester was formerly identified with Stone & Webster. He removed to Detroit and, at the beginning of the World War, took charge of construction at Camp Custer, Battle Creek, Mich. Later he was placed in charge of construction work at the Hog Island Navy Yard as division superintendent for Stone & Webster, but returned to Detroit as a construction and consulting engineer. Recently he was elected vice-president of the Apex Coal Company of Chicago.

RALPH M. OBERGFELL, associate electrical engineer of the Underwriters' Laboratories, Chicago, died Jan. 10, of pneumonia, after a brief illness. Mr. Obergfell was born in Chicago in 1888 and received his technical education at the Lewis Institute. Since 1914 he had been associated with the electrical department of the Underwriters' Laboratories with the exception of about a year and a half when he was with the American Expeditionary Forces in France. For the last few years he had been at the head of the electrical department in Chicago.

GEORGE W. MATHEWS, superintendent for the Foundation Company of New York, builder of the Insull power plant at Pekin, Ill., died of pneumonia Jan. 3 in his home in the latter city after a week's illness. He was 39 years old. Mr. Mathews had removed to Pekin last March to take charge of construction of the new power project and had made rapid progress with the work. He had been associated with the Foundation Company a number of years.

Prof. E. E. F. Creighton

ELMER E. F. CREIGHTON, electrical engineer with the General Electric Company, who was for years the company's expert on lightning protection, died Jan. 13 in Ellis Hospital, Schenectady. He had been identified with the General

E. E. F. CREIGHTON

Electric Company since 1904 and during this period was a close technical associate of the late Dr. Charles P. Steinmetz. In the course of his engineering career Professor Creighton devoted much time to high-tension and lightning protection investigations, and during the last few years he had been engaged in special research work for the general engineering laboratory. An inventor of many protective devices for electrical systems, he held a total of 66 United States patents.

A native of California and a graduate of Leland Stanford University, Mr. Creighton rounded out his technical education at the Sorbonne in Paris and at the École Supérieure d'Electricité. Following his return from Paris in 1900 he again joined the staff at Leland Stanford to continue the teaching he relinquished to go abroad. One year later he transferred his interests to the East as head of the experimental department for the Stanley Electric Manufacturing Company at Pittsfield, and when the Stanley organization was taken over by the General Electric Company in 1904 he removed to Schenectady. From 1904 to 1906 Professor Creighton was assistant to Dr. Steinmetz, who was head of the electrical engineering department at Union College, and it was at this interval that an experimental laboratory, conducted by these two and others of the faculty, but designed to serve the needs of the General Electric Company, was established. The research work was continued at the college until 1913, when the laboratory was moved to the Schenectady plant of the General Electric Company, where it has since remained.

Professor Creighton was a fellow of the American Institute of Electrical Engineers and served on many technical committees, including that on meetings and papers. He was also a member of the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education, the American Electrochemical Society, the American Academy for the Advancement of Science, the American Physical Society and other technical organizations.

W. C. CHAPPELL, electrical engineer, died late in November, 1927, in Monrovia, Cal., after a long illness. In the course of his engineering career Mr. Chappell visited Scotland, Austria, England, his native land, Canada and the United States. While in America he served as erecting engineer for the Columbia Electric Railway, in the same capacity with the General Electric Company in Philadelphia, and subsequently with Gay & Son, Los Angeles, as design engineer. Mr. Chappell was a member of the American Institute of Electrical Engineers.

LEWIS P. MEAD, president of the Mead Electric Company, Ltd., electrical engineers and contractors, Montreal, died at his home in that city Dec. 28, in his sixtieth year. Mr. Mead was born in Providence, R. I., and moved to Montreal in 1897 to take up the position of factory superintendent of the Eugene F. Phillips Electrical Works, Ltd. In 1910 he formed the Mead Electric Company, Ltd. He was for some years a lecturer in electrical engineering at the Montreal Technical School.

ROBERT MILLER, general manager for the General Electric Company in the Rocky Mountain States, with headquarters at Denver, died Jan. 5, after a short illness. He was 48 years of age. Mr. Miller started with the General Electric Company in the East, was made sales manager at Salt Lake City in 1911 and about two and one-half years ago was advanced to the position he held at the time of his death.

A. F. MESERVEY, formerly general manager of the Fort Dodge (Ia.) Light & Power Company, died Jan. 3 in his home in Long Beach, Calif., where he had made his home since his retirement from active life twelve years ago. Mr Meservey was 77 years of age.

Financial and Statistical News

Utility Markets Inactive
Money Rates Firm
New Financing Active

PUBLIC utility securities for the most part have shared the inactivity which has characterized the greater part of the securities markets this week. Few price changes of any great significance are recorded, although averages are marginally higher than a week ago.

Money rates are again a subject of special interest in relation to current market movements. Hardening of rates at the beginning of the year is contrary to precedent. The tendency during recent years is the reverse, and factors governing the money market at this time of year would normally be expected to produce ease rather than firmness. The situation is, therefore, connected with the more or less uncertain effect of the expansion in brokers' loans, and this revives the question of the policy of the Federal Reserve banks in this connection. In any event, current firmness of funds and anticipation in certain quarters of increased firmness have had a definite slowing-up effect in the markets.

Bond prices continue in active demand with firming prices. The volume of new financing has again struck its pace, as indicated by the large number of new issues which have come forward this week and last.

New Twenty-Million-Dollar German Loan to Be Floated

Negotiations for a twenty-million-dollar loan for the Westphalia United Electric Power Corporation of Germany have been closed and public offering is expected in the near future. Proceeds of the issue will be used for extensions to the plant.

Week's New Issues Total Almost $50,000,000

The largest issue of the year up to the present is $36,000,000 of 5 per cent debentures, series A, of the Continental Gas & Electric Corporation. The issue, which was sold at 95½ and accrued interest to yield about 5.30 per cent, is for the purpose of retiring all of the company's outstanding securities except its 7 per cent prior preference stock and 110,000 shares of $7 preferred stock, series A, of the Kansas City Power & Light Company, a subsidiary.

An issue of $2,400,000 collateral trust 6 per cent bonds, series A, of the United Public Service Company was also sold this week. The funds are to be used for the purpose of acquiring additional subsidiary securities, as provided in the indenture. The United Public Service Company owns all of the capital stocks of a group of subsidiaries serving communities in Ohio, Indiana, South Dakota, Kentucky, etc. The bonds were sold at 98 and interest to yield over 6.20 per cent.

The National Electric Power Company sold an issue of $10,000,000 of 5 per cent gold debentures this week, to be used in the retirement of the company's 6 per cent secured gold bonds. The issue was sold at 94½ and interest to yield over 5.30 per cent.

Financing was carried out during the week also by one of the Duke-Price interests in Canada, the Saguenay Electric Company. This company sold $1,360,000 of 5½ per cent first mortgage and collateral trust bonds. Saguenay Electric has acquired a number of power and light companies in Quebec.

Power Corporation Changes Set-Up

The stockholders of the Power Corporation of New York at their annual meeting on Jan. 10, held at the offices of the St. Regis Paper Company, voted to reduce the number of shares of both preferred and common stock. It was decided to reduce the total number of shares from 850,000 to 820,000. Under the old plan the company had 750,000 shares of common and 100,000 shares of preferred stock. Under the new plan the concern will have 750,000 shares of common and 70,000 shares of preferred stock. All of the directors of the company were re-elected to serve another year.

California Commission Exercises Rigid Supervision

ANY existing feeling that the supervision of public utility commissions is not sufficiently rigid is refuted in so far as California is concerned by the commission's report, recently issued. Analysis of the report shows that since its inception the commission has denied applications to issue approximately $110,000,000 and dismissed applications to issue $116,500,000, or a grand total of more than $226,000,000. The result of this action is to protect investors and the consumers of public utility service, and it is evident that the commission is not evading its veto duty in regard to new issues. According to records, the commission granted permission for the issue of $252,323,000 of stocks, bonds and notes and other evidences of indebtedness during 1927, as against $158,012,000 in 1926.

Tabulations for the past year indicate that although a considerable volume of bonds was authorized, the year was especially favorable for stock financing, the amount of stock authorized increasing from $50,576,000 in 1926 to $151,562,730 in 1927. It appears from applications filed with the commission that not only was more stock sold, but the issuing companies were able to dispose of it more readily at higher prices and under better terms than previously. The amounts authorized during the past two years, exclusive of $247,000,000 which was for reclassification of the capital stock of the Pacific Gas & Electric Company and Southern California Edison Company, are classified by years and main groups as follows:

As usual, the bulk of the securities were authorized to be issued by gas and electric companies and for additions, betterments and construction purposes. While few new units of electric production capital were started during the year, a considerable volume of work and money was expended on construction programs, commenced in earlier years of generating expansion, the Southern California Edison Company proceeding with its Big Creek development and its Long Beach steam plant, Feather River Power Company with its Bucks Creek project, San Joaquin Light & Power Corporation with its Kings River development, Pacific Gas & Electric Company and Sierra & San Francisco Power Company with their Tuolumne development and the California Oregon Power Company with its Prospect plant on the Rogue River. The various applications filed with the commission indicate increasing expenditures for distribution facilities to meet demands for service from an ever-increasing number of consumers.

At the beginning of 1928 applications were pending before the commission involving requests to issue $43,734,803 of securities, and it appears from these undecided matters and from construction budgets filed by some of the companies that the commission will be called upon during the coming year to pass on a large volume of securities to enable the continuance of the development and expansion of California's public utilities which is demanded by the steady growth that has taken place.

LAST TWO YEARS' UTILITY FINANCING IN CALIFORNIA

	Stocks	Bonds	Notes	Other Evidences of Indebtedness	Total
1926	$50,576,067	$103,406,600	$1,789,854	$2,150,000	$158,012,521
1927	151,562,730	197,334,300	3,126,163	300,000	252,323,193

American Gas & Electric Sells All but Electric Utilities

The American Gas & Electric Company has sold several railway and bus properties in Portsmouth and Ironton, Ohio; Ashland, Ky.; Huntington, W. Va., and Wildwood, N. J. The company retains the electric light and power properties in these centers. The sale of these companies leaves American Gas & Electric with gross receipts of subsidiaries derived almost entirely from electric power and light operations.

Common Dividend Increased by Middle West Utilities

Directors of the Middle West Utilities Company on Jan. 10 passed a resolution to the effect that, starting with the common dividend, payable May 15, quarterly distributions at the rate of $7 per share per annum will be made. This will mean that the 7 per cent preferred stock will go on an 8 per cent annual dividend basis beginning April 15. The regular quarterly dividend of $1.50 per share has been declared on the common stock (no par value), payable Feb. 15 to holders of record Jan. 31. This dividend rate has been paid since May 15, 1926, inclusive.

Stock Exchange in New York Consolidation

The certificate of consolidation, made a part of the petition for the consolidation of the Niagara, Lockport & Ontario Power Company and the Western New York Utilities Company, Inc., under the name of the Niagara, Lockport & Ontario Power Company, states that the new corporation is to have 827,500 shares of stock, of which 500,000 shares will be preferred stock, par $25, and 327,500 shares of no-par-value common stock. Holders of preferred stock, par $100, of the Niagara, Lockport & Ontario Power Company are to receive under the proposed consolidation 4⅔ shares of preferred stock of the new company, in exchange for each share now owned. Preferred stockholders of the Western New York Utilities Company, Inc., are to receive $2.50 in cash and four shares of preferred stock of the new company, also the sum of 58⅓ cents in lieu of dividend for December, 1927. Holders of the 300,000 shares of common stock of the Niagara, Lockport & Ontario Power Company and of the 27,500 shares of common stock of the Western New York Utilities Company, Inc., are to receive common stock of the new company on the basis of share for share.

Duquesne Light to Change Capitalization

Stockholders of the Duquesne Light Company will meet March 10 to vote on converting 250,000 shares of 8 per cent cumulative participating preferred stock, series A, of $100 par value, into 1,000,000 shares of common stock without par value, and converting the 250,000 shares of $100 par value common stock into 1,000,000 shares of no-par common, making a total of 2,000,000 shares outstanding. Stockholders of the company at the same time will vote on the proposal to increase the common from 2,000,000 to 4,000,000 shares and to issue $50,000,000 of 5 per cent cumulative first preferred stock.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 17	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	149	140½*	149*
Ala. Pwr., $7 com. pf.—no par	114½	107	115
Allis-Chalmers Mfg., 6% com	116½	115½*	120½*
Aluminum Co. of Amer., com	122½	120*	125*
Aluminum Co. of Amer., 6% pf	106½	105½*	106½*
Amer. & Foreign Pwr., 7% pf.—no par	107	105½*	108½
Amer. & Foreign Pwr., com.—no par	23	22½*	24½*
Amer. Bosch Magneto, com.—no par	21	20½*	22½*
Amer. Brown Boveri Elec.†	15	14½*	17*
Amer. Brown Boveri Elec., pf. $7	60	58*	63*
Amer. Gas & Elec., 6% pf.—no par	107	95½	108½
Amer. Gas & Elec., com. †—no par	119½	117½*	123½*
Amer. Lt. & Trac., 6% pf	115½	115½*	115½*
Amer. Lt. & Trac., new com	k174	164½	186
Amer. Pwr. & Lt., 6% pf	109½	109*	109½*
Amer. Pwr. & Lt., com. †—no par	62½	62½*	65½*
Amer. Pub. Serv., 7% pf	k 98½	88	104
Amer. Pub. Serv., com. †	k 70	65	75
Amer. Pub. Utilities, 7% pfc. pf	92	73	90
Amer. Pub. Utilities, 7% pr. pf	a 96	92	96½
Amer. Pub. Utilities, com	k 60	58	70
Amer. States Sec., A	4	2½	5½
Amer. States Sec., B	4½	2½	5½
Amer. Superpwr., 6% pfc pf.—25	k 29½	26½	29½
Amer. Superpwr., 6% 1st pf	l 102½	....	....
Amer. Superpwr., Class A†—no par	37½	37*	38*
Amer. Superpwr., Class B†—no par	38½	37½*	38½*
Amer. Wtr. Wks. & Elec., 6% pf	k102	99½	103½
Amer. W. W. & E., com. new—no par	57½	57*	61*
Anaconda Copper cap. $3	55½	54½*	59½*
Appalachian Electric Pwr., 7% pf	108½	100	109
Arkansas Pwr., & Lt. 7% pf	107	101	108
Assoc. Gas & Elec., $3.50—50	54	....	....
Assoc. Gas & Elec., pf.—$6—no par	98	85	98
Assoc. G. & E., Class A, 10—no par	47½	47½*	51½*
BABCOCK & WILCOX, 7% com	120	113	132
Binghamton L., H. & P., $6 pf	103	93	103½
Birmingham Elec., pf.—$7—no par	109	105	111½
Blackstone Valley G. & E., 6% pf	k107	103	110
Blackstone Valley Gas & Elec., 10% com.—50	k128	98	153
Blaw-Knox, com.†	¢ 93½	70	105
Brazilian Trac., Lt. & Pwr., $7 com	f215	....	....
Broad River Pwr., 7% pf	105½	97	105½
Brooklyn Edison, 8% com	214	206½*-219½*	
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	l 26	....	....
Buffalo, Niagara & East. Pwr. com. $1.20—no par	l 33	....	....
CALIFORNIA ELEC. GENERATING, 6% pf	k 98	96	104½
California Ry. & Pwr., 7% pf	k135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	l109½	109*	110½
Central & S. W. Util., $7 pf.—no par	a102½	92½	99½
Central & S. W. Util., pr. in. $7 pf.—no par	a106	98½	105½
Central Ark. Ry. & Lt., 7% pf	102½	100	104
Central Ill. Pub. Serv., $6 pf	a 98	85½	100
Central Ind. Pwr., 7% pf	a 95	85½	95½
Central Maine Power, 6% pf	95	....	....
Central Maine Power, 7%	106	102	110
Central Pwr. & Lt., 7% pf	104½	100½	105
Central States Elec., 7% pf	99	93	103½
Century Elec., 6% com	b142	142*	142*
Chicago Fuse Mfg., com.—$2.50 no par	a 31	30	35½
Cincinnati Gas & Elec., 5% com	g 99½	99½*	100*
Cities Service, $6 pf.—no par ex. div	k 95½	87½	95½
Cities Service, pf. B—no par ex. div	l 8½	7½	8½
Cities Service, pf. BB—no par	k 88½	81	88½
Cities Service, com.—20	l 54	54*	56*
Cities Service, Bks. Shrs.—10	m27½	22½*	27*
Cities Service Pwr. & Lt., 7% pf	106½	105½*	106½*
Cities Service Pwr. & Lt., 6% pf	96½	95½*	96½*
Cleveland Elec. Illg., 6% pf	112	108	114
Cleveland Elec. Illg., 10% com	350	285	370
Columbia Gas & Elec., 6% pf	108½	108*	110½*
Columbia G. & E. com. $5—no par	91½	89½*	92½*
Columbus Elec. & Pwr., $2 com.—no par	65	....	....
Columbus Elec. & Pwr., 7% pf	107	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf	107	98½	108½
Columbus Ry., Pwr. & Lt., 6½% pf. B	105	96	106
Columbus Ry., P. & L. com.—no par	105	75	110
Commonwealth Edison, 8% com	a168	138	173
Commonwealth Pwr., 6% pf	102½	102½*	104½*
Commonw'th Pwr., $2, com.—no par	64½	62½*	65½*
Conn. Lt. & Pwr., 8% pf	121	119	123
Conn. Lt. & Pwr., 7% pf	117	112	119
Cons. Gas of N. Y., pf	101½	101½*	102½*
Cons. Gas of N. Y., com. $5—no par	121½	119½*	125½*
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf	e111	110½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf	e111½	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf	e110½	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf	e125½	127	130½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	e 68½	51	71
Consolidated Pwr. & Lt., 7% pf	105	100	106
Consumers Pwr., 6% pf	104½	100	106½
Consumers Pwr., 6.6% pf	106½	103	107½
Continental Gas & Elec., 8% pfc. pf	110	103	110
Continental Gas & Elec., 7% pr. pf	108	100	107½
Conti. G. & E. com. $4.40—no par	k225	210	265
Crocker Wheeler, com.†	25	23	38
Crocker Wheeler, 7% pf	85	78	88
DALLAS PWR. & LT., 7% pf	111	107	111½
Dayton Pwr. & Lt., 6% pf	108½	101	109½
Detroit Edison, 8% com	174	166½*	176½*
Dubilier Condenser, com.—no par	k 3½	2	5½
Duke Pwr., cap	139½	139½*	145*
Duquesne Lt., 7% pf	115½	115½*	115½*
EASTERN NEW YORK UTIL., $7 pf	k110½	102	112½
Eastern New York Util. com	k 65	70	75
Eastern States Pwr. $7, com	11	9	14
Eastern States Pwr., pf	97	90	99
East. Tex. Elec., 7% pf	107	106	109
Edison Elec. of Boston, $12 com	d262	217	267
El Paso Elec. 7% pf	111½	105	112½
Elec. Bond & Share, 6% pf	l109½	109½*	111½*
Elec. Bd. & Sh. Sec., com. $1—no par	l 77½	76½*	80½*
Electric Household Util.†	a 15	11	15½
Elec. Investors, 6% pf.—no par	101	92	101
Elec. Investors, com.†—no par	40½	40½*	43½*
Elec. Pwr. & Lt., ctfs. pf	107½	106½*	107½*
Elec. Pwr. & Lt., ctfs., 40% pd	120½	120½*	121½*
Elec. Pwr. & Lt., ctfs., com.—no par	31½	28½*	31½*
Elec. Refrig. cap.†	11½	11½	13½
Elec. Ry. Securities, com.—no par	6½	....	....
Elec. St. Battery com. $5.25—no par	71½	70½	75½
Elmira Wtr., Lt. & R.R., 7% pf	k105	99	105½
Empire Pwr., pfc.†	30½	27½*	30½*
Engr. Pub. Serv., com.—no par	35½	34½	35½
Eureka Vacuum Cleaner, com. $4—no par	75½	74	79
FAIRBANKS MORSE, 7% pf	k106	107	112
F.-M., com.—$3—no par	36½	32½*	36½*
Federal Lt. & Trac., com. $1.40	42½	42*	43½*
Federal Lt. & Trac., $6 pf.—no par	1o0	98*	101½*
Florida Pwr. & Lt., 7% pf	106½	104½*	106½*
Ft. Worth Pwr. & Lt., 7% pf	l113½	113*	114½*
GALVESTON-HOUSTON ELEC. 6% pf	75	68	85
Galveston-Houston Elec., com	30	26	32
General Cable, Cl. A $1 no par	58	57*	59*
Gen. Elec. $3 com.—no par	132½	130*	138½*
Gen. Elec., special—6%	11½	11½*	11½*
Gen. Gas & Elec. (Del.) com A $1.50—no par	k 35	34	47½
Gen. G. & E. (Del.) pf. A $8—no par	k122½	113½	123½
Gen. G. & E. (Del.) pf. A $7—no par	k107	98½	110½
Gen. G. & E. (Del.) pf. B $7	105½	105½*	106*
Gen. Pub. Serv., $7 cum. pf., no par	k110	102	112
Gen. Pub. Serv., com., no par	17½	16½*	17½*
Ga. Ry. & Pwr., 8% pf	k125	119	125
Ga. Ry. & Pwr., 7% pf	k113½	106	115
Gt. Western Pwr., 7% pf	l104½	....	....
IDAHO PWR., 7% pf	109	103	110
Ill. No. Utilities, 6% pf	k 96	88	97
Ill. Pwr. & Lt., 7% pf	104	99	104½
Ingersoll Rand com	92	91*	94*
Int. Combus. Engr., com. $2—no par	51½	49*	55½*
Int. Combustion Engr., 7% pf	105	104½*	105½*
Int. Util., Class A—$3.50—no par	k 48½	24	53
Int. Utilities, Class B—no par	9½	9½*	10½*
Interstate Pwr., pf.—$7—no par	97½	93	100
Interstate Pub. Serv., 7% pf	102	98	104
Iowa Ry. & Lt., 7% pf	k 98½	97	100
JERSEY CENTRAL PWR. & LT. CO., 7% pf	105½	97½	108
Johns-Manville, com.†—no par	116½	114½*	123*

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f* Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 14 *l*Bid price Wednesday, Jan. 18. *m*Latest quotations available. †Dividend rate variable. *1928

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 17	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf. $7	k115	109	116¼
Kansas Gas & Elec., 7% pf.	l108¼	107*	109*
Kentucky Hydro-Elec., 7% pf.	a102¼	94¼	104
Kentucky Sec., 6% pf.	k 91	83	90
Kentucky Sec., 5% com.	140	100	135
Kentucky Utilities, 6% pf.	k101	95	101½
LACLEDE GAS LT., 12% com.	k200	173½	267½
Lehigh Pwr. Sec., com.—no par	20½	19¼*	20½*
Long Island Ltg., 7% pf.	110½	110¼*	111*
Long Island Ltg., com.†—no par	170	139	180
Los Angeles Gas & Elec., 6% pf.	104½	98	105
Louisville Gas & Elec., cl. A. $1.75	28¼	28¼*	29*
MAN. ELEC. SUPPLY, cap. $5—no par	50	50*	54½*
Manila Elec., com.†—no par	k 45½	40	60
Maytag Mfg., com. .50—no par	34	33½*	34½*
Memphis P. & L., pf.—$7—no par	k109	107	111
Metropolitan Ed., pf.—$6—no par	104½	93	106
Metropolitan Ed., pf.—$7—no par	108	104	110
Metropolitan Ed., com. $5—no par	k100	60	72
Middle West Utilities, 7% pf.	a119½	110½	119
Middle West Util., 7% pr. lien	a128	117½	127
Middle West Util., com. $6—no par	a129½	108	125
Midland Utilities, pr. ln. 6% pf.	a 95½	91½	96½
Midland Utilities, 7% pf. A	a104	96½	103½
Milwaukee Elec. Ry. & Lt., 7% pf.	k103	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	l108	107*	109*
Miss. River Pwr., 6% pf.	107½	94	108
Miss. River Pwr., 3% com.	m 62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	108	100	109
Mohawk Hudson Pwr., 2d pf.—$7—no par	106	105*	106*
Mohawk Hudson Pwr., com.—no par	29½	29¼*	30½*
Montana Pwr., 5% com.	104	102¼*	106¼*
Montreal Pwr., 7½% com.	f 91½	....	....
Mountain States Pwr., 7% pf.	102½	97	103
Mountain States Pwr., com.†	17	....	....
NASSAU & SUFFOLK LTG., 7% pf.	110	98	110
National Carbon, 8% pf.	a139	130½	139½
National Elec. Pwr., A†	a 28	22	28½
National Lt., Ht. & Pwr., com.	k 24	20	30
National, Light, Ht. & Pwr., 5% pf.	k 72	70	80
National Pwr. & Lt., pf.—$7—no par	109½	108¼*	109½*
National Pwr. & Lt., com.†—no par.	22½	21½*	23½*
National Pub. Serv., 7% pf.	99½	93	102
National Pub. Serv., 7% pte., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par	23	22*	23*
National Pub. Serv., B com.—no par	26½	24¼*	27½*
Nebraska Pwr., 7% pf.	l110½	110*	111½*
Nevada-Calif. Elec., com.	k 34	25	36½
New Brunswick Pwr., 4% pf.	k 60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	k104	98½	104
New Eng. Pub. Serv., pf. $7	102½	101*	102½*
New Orleans Pub. Serv.—7% pf.	108½	103	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	100	91	100
N. Y. Central Elec., 7% pf.	k102½	101	104
New York Power & Light 8% pf. no par	114	....	....
New York Power & Light, 8% pf.	114	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	k109	110	115
Newport News & Hampton Ry., Gas & Elec., 7% pf.	k109	110	115
Niagara Falls Pwr., 7% pf.—25	28½	28*	28½*
Niagara, Lock & Ont. Pwr., 7% pf.	k115	110½	116
No. Amer., 6% pf.—50	54½	53¼*	54½*
No. Amer., com.—10	61½	58¼*	62½*
No. Amer. Edison, $6 pf.—no par	104½	103½*	104½*
No. Caro. Pub. Serv., pf.—$7—no par	103½	93	105
Northeastern Pwr., com.	19½	19½*	21½*
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	18½	18*	19½*
No. Ont. Lt. & Pwr., 6% pf.	k 98	84	95
No. Ont. Lt. & Pwr., 4% com.	k 72	73	78
No. States Pwr. (Del.), 7% pf.	109½	108½*	109½*
No. States Pwr. (Del.), 8% com.	124½	123*	128*
No. Texas Elec., 6% pf.	45	45	70
No. Texas Elec., com.	5	5	36
OHIO BRASS, com. B $4—no par	k 95½	76	116½
Ohio Brass, 6% pf.	k110	100	111
Ohio Pwr., 6% pf.	105	96	106
Ohio Pub. Serv., $6 pf.	k103	95	102
Ohio Pub. Serv., 7% pf.	110	103	111
Ohio River Edison, 7% pf.	108½	103	109½
Oklahoma Gas & Elec., 7% pf.	108	....	....
PACIFIC Gas & ELEC., 6% pf.	27½	26½*	27½*
Pacific Gas & Elec., 8% new com.	k 47½	31	50
Pacific Pwr. & Lt., 7% pf.	l106	106*	108*
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 78	75½	80
Penn-Ohio Edison, 6% pf. no par	95	94½*	96*
Penn-Ohio Edison, 7% pf.	k107½	97½	104
Penn-Ohio Pwr. & Lt., 7% pf.	109	99	110
Penn Pwr. & Lt.—$7—no par	l109½	109½*	110½*
Penn Wtr. & Pwr., 8% com., new	e 72½	47½	75
Phila. Co., 5% pf.—50	k 48½	40	51
Phila. Co., 6% pf.—50	52½	52*	52½*
Phila. Co., com.—50	k149	85½	153½
Phila. Elec., 8% com.—25	c 57½	46	58½
Portland Elec. Pwr., 7% pf.	102	97½	102½
Portland Elec. Pwr., 6% pf.	86	78	84
Portland Elec. Pwr., 6% 2d pf.	75	55	70
Portland Elec. Pwr., com.	33	22	30
Potomac Elec. Power, pf.	k111	110	111½
Pwr. Sec., pf.—no par	k 60	28	60
Pwr. Sec., com.—no par	k 12	5	15
Public Serv. of Colorado, 7% pf.,	l107	....	....
Pub. Serv. of N. J., 6% pf.	104½	103½*	105*
Pub. Serv. of N. J., 8% pf.	135	134*	135*
Pub. Serv. of N. J., $2 com.—no par	42½	41½*	42½*
Pub. Serv. of No. Ill., 6% pf.	a111	101½	113½
Pub. Serv. of No. Ill., 7% pf.	a120½	112	120½
P. S. of No. Ill., com. $8—no par	a159½	140½	161½
Pub. Serv. of No. Ill., $8 com.	k160	130½	160
Pub. Serv. of Okla., 7% pr. ln.	k103	90	103
Pub. Serv. Elec. & Gas, 6% pf.	110	109*	110*
Puget Sound Pwr. & Lt., 7% pf.	k108	105	109
Puget Sound Pwr. & Lt., $6 pf.—no par	99	....	....
Puget Sound Pwr. & Lt., com.	41½	34½*	41½*
RADIO COPR. OF AMER., $3.50 pf.—50	k 55½	49	57
Radio Corp. of Amer., com.—no par	100½	88½*	104½*
Rhode Island Public Service, pf. $2—no par	30½	28½	30½
Rochester Gas & Elec. 6% pf. D	k105½	101	103½
Rochester Gas & Elec., 7% pf. B	107	105	107
Rochester Gas & Elec., 6% pf. C	105½	101½	103½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	k111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	k 75	70	75
Servel Corp.	k 1	10cts	10½
Sierra Pacific Elec., 2% com.	k 32	24½	31½
Sioux City Gas & Elec., 7% pf.	107	99	105½
Southeastern Pwr. & Lt., pf.—$7—no par	l108	....	....
Southeastern Pwr. & Lt., pte. pf.	l 85½	....	....
Southeastern Pwr. & Lt., com.—no par	k 43	29½	46
So. Calif. Edison, 8% pf.	k 45	36½	46
So. Calif. Edison, 7% pf.	k 28	27½	28½
So. Calif. Edison, 6% pf.	k 26	24½	27
So. Calif. Edison, 8% com.	44	43½*	44½*
Southern Cities Utilities, 7% pf.	k 70	67	90
Southern Cities Utilities, com. $4	m 30	23½	42½
Southwestern Lt. & Pwr., A $3	70	60	65
Southwestern Lt. & Pwr., B	70	60	65
Southwestern Lt. & Pwr., com. $5 pf.	88½	83	91½
Southwestern Pwr. & Lt., 7% pf.	k110	103	113
Springfield (Mo.) Ry. & Lt., 7% pf.	m102	95	102
Standard Gas & Elec., 8% pf.	66	65*	66*
Standard Gas & Elec., 7% pr. pf.	110	103	113
Standard G. & E., com. $3.50	59	57½*	59½*
Standard Power & Light, com.	30	30*	33½*
Standard Pwr. & Lt., 7% pf.	104	98	105
Staten Island Edison, pf.—$6—no par	101½	99	103
Superheater, $6 com.—no par	163	170	185
Syracuse Lighting, 7% pf.	k111	103	111
Syracuse Lighting, 8% pf.	k117½	114	119
TAMPA ELEC., com. $2	63	62½*	63*
Tenn. Elec. Pwr., 6% pf.	102½	92	103
Tenn. Elec. Pwr., 7% pf.	109½	103	110
Terre Haute, Ind. & East. Trac., 5% pf.	k 26	20	30
Terre Haute, Ind. & East. Trac., com.	k 1	1	3
Tex. Pwr. & Lt., 7% pf.	l114	113½*	115*
Tide Water Pwr., 8% pf.	108½	105	111
Timken Roller Bear., com.—$4 no par	129½	126½*	134*
Toledo Edison, 7% pf.	l109½	102*	107*
Toledo Edison, 6% pf.	k105	95	105
Toledo Edison, 6% com.	k100	93	102
Tri-City Ry. & Lt., 6% pf.	k 97½	96	99
UNITED GAS & ELEC., 7% pf.	101	98	103
United Gas & Elec. (N. J.), 5% pf.	74	70	77
United Gas Impr., 8% com.—50	c115½	89½	118½
United Lt. & Pwr., pf.—$4—no par	a 55	50	57
United Lt. & Pwr., pf.—$6 .50—no par	a 98½	87	97½
United L. & P., com. A .48—no par	14½	13½*	14½*
United L. & P., com. B .48—no par	k 20	14	20
Utah Pwr. & Lt., 7% pf.	l110	109½*	111*
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	k200	215	225
Utilities Pwr. & Lt., 7% pf.	98	93	100
Utilities Pwr. & Lt., com. A $2	29	28½*	29½*
Utilities Pwr. & Lt., com. B $1—no par	k 19½	13½	23½
VERMONT HYDRO-ELEC., 7% pf.	k 97	95	100
Virginia Elec. & Pwr., 7% pf.	k108	105	110
WAGNER ELEC., 7% pf.	b 97	97*	97½*
Wagner Elec., com.—no par	b 38½	37½*	38½*
Washington Ry. & Elec., 5% com.	464	180	475
Washington Ry. & Elec., 5% pf.	101½	....	....
Washington Wtr. Pwr., 8% com.	k178	136	182
West Penn Elec., 7% pf.	113½	111½	114½
West Penn Elec., Cl. A $7	107½	106½*	109*
West Penn Pwr., 7% pf.	115½	114¼*	116½*
West Penn Pwr., 6% pf.	110	109½*	113*
West Virginia Lt., Ht. & Pwr., 7% pf.	k 95	94	100
Western Pwr., 7% pf.	k103	98	105
Western States Gas & Elec., 7% pf.	102½	96	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com.—50	91½	88½*	95½*
Weston Elec. Instrument, Cl. A $2—no par	30½	30	34½
Weston Elec. Instrument, com.—no par	k 12½	11	18½
Wheeling Elec., 6% pf.	k103	95	104
Worthington Pump, 7% pf. A	k 46½	44	61½
Worthington Pump, 6% B	k 42½	37	54½
Worthington Pump, com.	k 28½	20½	46
YALE & TOWNE com. $5—25.	75	73½*	75*

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 14 *l*Bid price Wednesday, Jan. 18. *m*Latest quotations available. †Dividend rate variable. *1928.

Canadian Companies Issue Annual Reports

The fourth annual report of the Ottawa & Hull Power Company, Ltd., recently issued, covering the twelve months ended Oct. 31, 1927, reveals a year of further satisfactory progress. Gross revenue for the twelve months amounted to $398,795. In the preceding period of fourteen months the gross revenue was $446,540, equivalent to a rate of $382,748 for twelve months. Expenses and taxes for the year under review were actually lower than those for the preceding period, which was longer by two months. Bond interest and preferred dividends were proportionately smaller. After these deductions there remained a surplus of $46,725. Gross revenue of the Ottawa River Power Company, Ltd., a subsidiary of the Ottawa & Hull Power Company, for the twelve months ended Oct. 31, 1927, amounted to $356,126, as against $274,953 in the preceding fiscal year, which comprised only ten months of operation. After deducting expenses and taxes, interest charges and depreciation reserve there remained a surplus for the year of $15,386, which was added to the previous surplus of $1,699, making a total of $17,086.

BRAZILIAN TRACTION ON $7 BASIS.—Brazilian Traction, Light & Power Company, Ltd., declared a quarterly dividend of $1.75 on the present $100 par common, placing the stock on a $7 basis, against $6 previously. Stockholders approved an increase in the authorized common shares to $200,000,000, from $120,000,000, and issuance of additional common stock to stockholders at $100 a share on basis of one new share for each five held, to be followed by a four-to-one split-up of all the common. The new common will be of no par value.

TOKYO STOCKHOLDERS RATIFY CONSOLIDATION.—Stockholders of the Tokyo Electric Light Company and the Tokyo Electric Power Company have ratified a proposal for the consolidation of the two companies. The consolidated organization will have a paid-in capital of more than $20,000,000 and a funded debt of about $100,000,000. The consolidated company is the largest corporation in Japan and one of the largest public utility operating companies in the world. It will operate at wholesale and retail in a territory comprising 13,000 square miles and having a population of 10,000,000, or nearly one-sixth of the population of Japan proper.

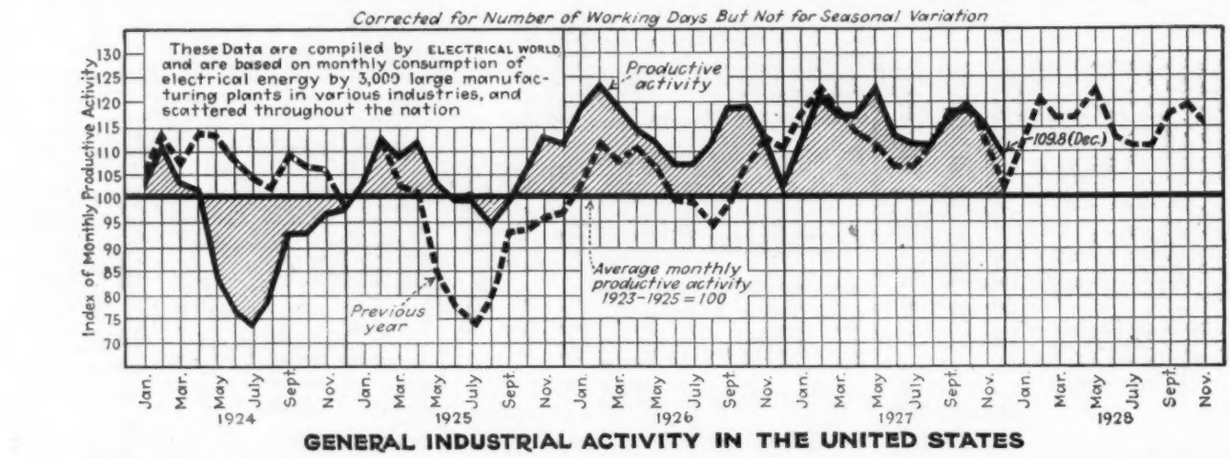
1927 General Production 2 Per Cent Over 1926

Less than Normal Seasonal Decrease During December — Rolling Mills, Steel Plants and Automobile Industries Report Increased Operations Over November

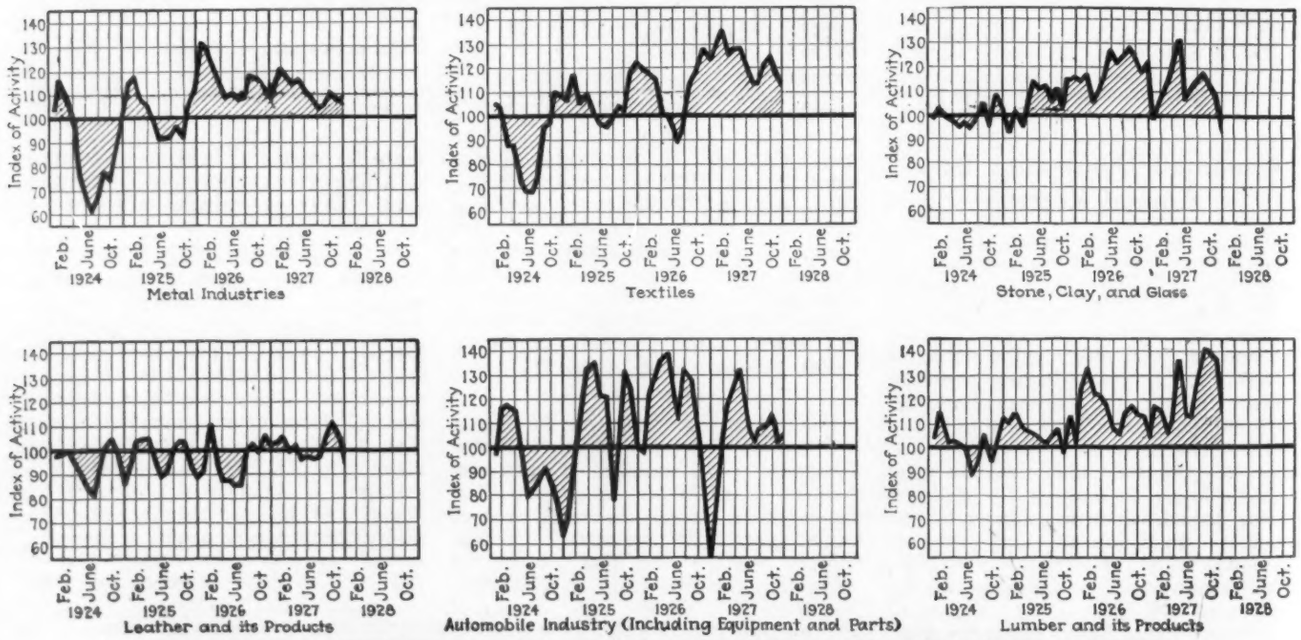
THAT the volume of general production during 1927 as a whole was about 2 per cent above that of 1926 is indicated by reports on electrical energy consumption received by the ELECTRICAL WORLD from approximately 3,000 large manufacturing plants scattered throughout the nation and in various industries, plants consuming more than 15,000,000,000 kw.-hr. of electrical energy per annum. The basic figures indicate that seven of the primary industrial groups—rolling mills and steel plants, leather and its products, textiles, lumber and its products, paper and pulp, rubber and its products, and the food and kindred products industries—turned out a volume of products greater than that in 1926, although in some of the groups the increased volume was very slight. On the other hand, five just as important industrial groups —ferrous and non-ferrous metal-working plants, automobiles, stone, clay and glass, chemicals and allied products and shipbuilding—were operating during the year as a whole at a lower rate than in 1926. When these various industrial groups are weighted in accordance with their importance in the national industrial structure, the rate of operations in general industry during 1927 is found to have been 2 per cent more than that of 1926.

The year closed with general industry operating at a rate of about 8 per cent greater than in December of last year. The low activity for December, 1926, was due largely to the depressing influence of operations in automobile manufacturing, both in the production of new cars and trucks and in the manufacture of automobile equipment and replacement parts. There was a very noticeable increase in the productive operations of these plants during the current December, an increase in operations of about 5.7 per cent being indicated. The rolling mills and steel plants also slightly increased their rate of activities during December, these two industrial groups—automobiles and rolling mills—being the only two industries to report an increased rate of operations during December over November. When the various industrial groups are weighted in accordance with their importance, the rate of operations of general industry during December is found to have been about 4.5 per cent less than in November, which is a materially smaller seasonal decrease than was witnessed during December, 1926.

QUEBEC POWER STOCK ON $2 DIVIDEND BASIS.—Directors of the Quebec Power Company have declared a quarterly dividend of 50 cents a share on the outstanding 400,000 shares of capital stock, no par value, payable Jan. 16 to holders of record Dec. 31. This is equivalent to $2 per share on the old capital stock of $100 par value, which was recently split up on a basis of four new shares for one old share. A quarterly dividend of 2 per cent was paid on the old shares on Oct. 15 last.


Corrected for Number of Working Days But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,000 large manufacturing plants in various industries, and scattered throughout the nation
Productive activity
109.8 (Dec.)
Average monthly productive activity 1923-1925 = 100
Previous year
Index of Monthly Productive Activity
1924
1925
1926
1927
1928

GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES



PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

Business News and Market Conditions

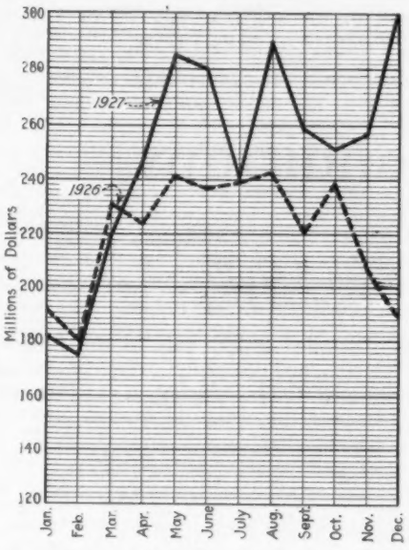
Engineering Contracts Show Gain in 1927

Increase of 14 per Cent Over 1926—December a Record Month with Contracts Highest for 1927

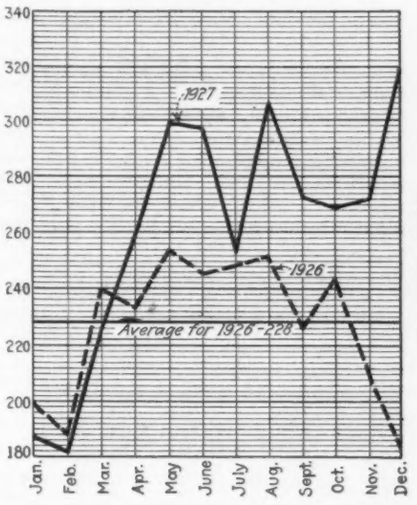
ENGINEERING construction volume for 1927 reached $3,253,766,000, which is $400,000,000 more than in 1926, an increase of 14 per cent, according to the *Engineering News-Record* statistics. December contracts averaged $76,500,000 per week, which is a record. It is $11,000,000 more than the weekly awards last month and $29,000,000 more than December, 1926, average weekly contracts. Several outstanding projects contributing to this large total were a hydro-electric development in Missouri, several pipe lines and two subway contracts, all totaling about $70,000,000. An unusual amount of awards for commercial building in New York totaled $65,700,000.

The construction volume index number for December is 319. This compares with 228 for the whole of 1926 and 100 for 1913. This means that the actual volume of contract letting in December, 1927 (not the mere money value of the contracts let), is 219 per cent greater than the volume for 1913. The index number contains the increment of construction and indicates the rate at which contracts are being let, as compared with 1913 awards. The index number for the average construction volume in 1927 is 262.

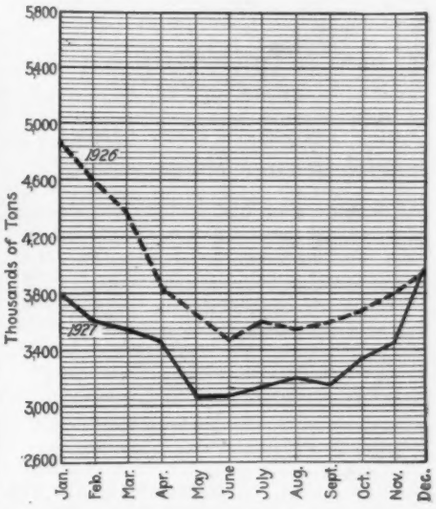
Street and road contracts in 1927 show a gain of $40,171,000, or 8 per cent more than 1926, for projects of $25,000 or more. Total awards for this class of construction were $525,069,000, and this is about 16 per cent of all heavy construction awards in 1927, higher than in any preceding year. Since 1913 there has been a consistent gain in street and road contracts, except in 1917 and 1918. The year 1927 was just 100 per cent higher than 1920.



CONTRACTS AWARDED IN THE UNITED STATES



CONSTRUCTION VOLUME AS COMPARED WITH AN INDEX OF 100 FOR 1913



UNFILLED TONNAGE AS REPORTED BY THE UNITED STATES STEEL CORPORATION

In the chart at the left the actual volume of construction is compared and not the mere money value of contracts let. (*Engineering News-Record* statistics.)

Actual building construction in 1927 was about 6 per cent less than in 1926, and, according to the Architectural Forum, building will continue in 1928 at least in the same volume, if not reaching even greater totals than in 1927.

Competition Will Be Keen, but Business Active

BY E. F. LENOIR

President Union Electric Manufacturing Company

FOR the coming year competition will be keener, but business will be active and there will be a goodly volume which can be obtained by hard work and keeping on one's toes. The year 1928 will be no worse than 1927. In fact, I look for it to be a little better. The United States is too large and its contact throughout the world is such that we cannot have what every one is so

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING DECEMBER, 1927

Totals for 1927 and 1926 (Thousands of dollars—000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Total for 1927	Canada
Waterworks	$15	$684	$402	$124	$837	$493	$2,555	*$53,189*	$91
Sewers	.....	1,361	277	4,674	855	384	7,551	*118,032*	815
Bridges	5,025	1,868	2,810	4,387	942	733	15,765	*143,645*	338
Excavations, drainage, etc	.....	493	25	385	180	721	1,804	*42,005*	1,053
Streets and roads	648	7,835	6,385	4,495	13,114	6,136	38,613	*525,069*	94
Industrial buildings	3,891	13,006	6,659	4,965	2,633	806	31,960	*321,315*	2,883
Commercial buildings	10,764	90,923	3,895	44,945	10,083	15,021	175,631	*1,632,338*	44,175
Federal government	655	1,200	444	29	643	758	3,729	*50,763*	.....
Unclassified	652	16,755	9,152	2,723	70,663	291	100,236	*367,410*	1,627
December, 1927	$21,650	$134,125	$30,049	$66,727	$99,950	$25,343	$377,844	*$2,853,847*	$51,076
November, 1927	15,035	76,183	52,792	61,627	30,813	20,872	257,322	.....	11,355
December, 1926	19,746	65,051	19,572	57,709	30,858	36,667	329,603	.....	3,647
Total, 1927	*234,274*	*988,994*	*290,465*	*775,955*	*593,417*	*370,661*	*3,253,766*	.....	*180,763*
Total, 1926	246,595	856,327	288,891	724,428	414,962	322,644	2,853,847	*3,253,766*	143,686

NOTE—Owing to five weeks of construction contracts being included in some months, as in September, the figure for the total contracts let, as shown in the table, does not agree with the figure as represented in the curve. In order to obtain comparable figures the curve is worked out on a four-week basis for each month.

often afraid of—a slump. Business is on a sound, hard-headed basis, which means hard work and lots of energy, and there is room for all of us to work and to live to make a profit. The only thing I fear is that some of the manufacturers will think it is necessary to reduce prices, but I believe that if the electrical industry increased its prices, it would increase business and naturally, of course, our profits. I certainly hope that the electrical industry will try to uphold prices in every way and eliminate freight allowances, rebates and all of the other extras which a great many are offering today.

Market Conditions

NEW ENGLAND has no outstanding orders or inquiries to report, and the Eastern district generally is feeling the effect of hand-to-mouth buying, though prospects for early activity are bright. An increase in the inquiries and orders from industrial firms seeking electrical equipment is noted in the Southeast. Good business continues in the central region of the nation, its volume being large for the first of the year. St. Louis, however, reports very few orders of contract size in the district for which it is the marketplace. Small motors are being ordered in considerable quantity in California, and motors and heavy apparatus, including hydro-electric equipment, are in reasonable demand in Seattle.

Non-Ferrous Metals Quiet with Easier Prices

Consumers of non-ferrous metals appear to be waiting for something to turn up, judging from the comparatively small volume of sales during the week ended Wednesday. None of the markets is dead, but the tonnage sold has been below the average. A sharp distinction can be drawn between the position of the important primary producers of copper and the so-called "custom" sellers. Without exception the former have been quoting 14⅛ cents, and that they had the courage of their convictions is proved by the fact that no copper was sold at this price during the week.

NEW YORK METAL MARKET PRICES

	Jan. 11, 1928 Cents per Pound	Jan. 18, 1928 Cents per Pound
Copper, electrolytic	14.05-14.125	14
Lead, Am. S. & R. price	6½	6½
Antimony	10¼	10¼
Nickel, ingot	35	35
Zinc spots	6	5.95
Tin, Straits	56½	54½
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Jan. 11, 1928, 15¼ cents.

Zinc in fair volume was traded in during the week at 5.62½ cents. A few sales for May-June delivery brought 5.65 cents. The lead market was disrupted in the week, with offerings on Wednesday by a Middle Western dealer at 6¼ cents, St. Louis, five points less than that which any producer had theretofore been willing to accept for this metal.

Small Sales Prevail in Eastern District

Curtailed orders rule in the Eastern district, and virtually every branch of the electrical industry is feeling the effects of a sluggish market brought about by hand-to-mouth buying. Prospects, however, are bright; sizable business appears ahead and is imparting a firm tone to the general situation. Inquiries are increasing both in volume and proportions as compared with the first two weeks of the month, but while a fair percentage is directed to central-station account, there are few immediate commitments in sight for heavy generating machinery or affiliated equipment. Substation and line equipment are developing an encouraging advance status in the New York market, and a leading manufacturer says that indications are that January sales will closely parallel those of the same month last year. About 93 per cent of current account, it is stated, is for outdoor-type apparatus. There is a fair movement in control equipment, according to a large producer, and the past few days are showing decided betterment. While the majority of present sales is for small account, the sum total is close to normal, approximately 50 per cent of current business being from prominent baking interests. A new cement mill in the St. Louis district is expected to place a large order for control equipment at an early date, and other important industrial projects are also maturing.

The Philadelphia market is operating under restricted buying, and industrial account is developing the majority of commitments. There is a fair demand for motors of medium capacity, with smaller units showing a tendency to lag. The business in wire and wiring materials is spotty and orders are light.

Construction activities in the Eastern district include the following: The Department of Mental Hygiene, Albany, N. Y., is asking bids until Jan. 25 for a cold-storage plant at the state hospital at Binghamton, including complete electrical work. The Mohawk-Hudson Power Corporation has acquired the Schodack Light & Power Corporation, operating at Castleton, N. Y., and vicinity, and plans line and other expansion in that district. The United Electric Light & Power Company, New York, has acquired an entire block of property on the Harlem River, adjoining its power plant at 201st and Academy Streets, for future expansion. The Pennsylvania Railroad Company, Philadelphia, is arranging the early construction of a cold-storage and refrigerating plant on Oregon Street, reported to cost in excess of $150,000, with equipment. Day & Zimmermann, Inc., Philadelphia, engineers, are taking bids until Jan. 31 for electric work, refrigeration, etc., for a cantonment and utilities at Graterford, Pa., for the Eastern State Penitentiary. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking bids until Jan. 24, for electric wiring devices (Schedule 8320), electric heaters (Schedule 8321) and insulation material (Schedule 8324.)

New England Trend Uneven with No Outstanding Orders

Little change during the past week as compared with the previous week is recorded for this district. No outstanding orders were reported, although sales are progressing and interest is quite marked along special lines. Industrial electric heating manufacturers are busy and report increasing interest; a number of heating furnace orders will be closed shortly. Industrial electric lighting is active, and present layouts reported by one prominent central-station group are far over the number last year. Line extensions are being planned for southeastern Massachusetts. Quotations for materials for service expansion are gaining.

Central-station supplies are less active, small-motor sales are steady, and industrial equipment is quiet. One manufacturer reports an inquiry for loom motors for individual drives; another records an encouraging trend toward sales among machine-tool manufacturers. Electric range sales are promising, and oil-burning equipment installations show a marked gain over last year for the past month.

Projects in view in this district are confined to hospital and institutional expansion. The Stone & Webster Corporation announces plans for the expansion of its southern Texas properties at a cost of $3,000,000.

Good Spring Trade Expected in St. Louis District

Very little business of contract magnitude is reported from the St. Louis district. Sales of stock sizes in motors and transformers for general purposes have been better than last week. A decrease was shown in the shipment of building materials and line-construction hardware. Several central-station jobs are being figured on, and the feeling reflected by manufacturers is that spring business will be good.

Construction projects reported are as follows: New Orleans is considering an ornamental lighting system in the business district. The Canadian Ice Company plans an ice-manufacturing plant on Gentilly Street, New Orleans,

to cost about $100,000. St. Louis is arranging an appropriation of $200,000 for improved lighting systems on a number of streets. The Southwestern Light & Power Company, Oklahoma City, will build a transmission line from Clinton to Arapaho, Okla. The Oklahoma Gas & Electric Company, Oklahoma City, plans an additional generating unit at its Horseshoe Lake power plant and will also enlarge the substation on Broadway, Oklahoma City. The Texas Power & Light Company, Dallas, plans extending its transmission system to Briggs, Tex., and vicinity. Fort Worth plans an ornamental lighting system on Magnolia Avenue and Camp Bowie Boulevard. The West Texas Utilities Company, Abilene, Tex., has authorized the immediate construction of a power plant at Lake Pauline, near Quanah, Tex., to cost about $1,500,000. The Gulf Public Service Company, Jacksonville, Tex., is considering a transmission line from Jacksonville to Troup, Tex. The Central Power & Light Company, San Antonio, plans extensions in the ice plant at Victoria, Tex., to increase capacity to 120 tons, to cost about $80,000.

Industrial Business Picking Up in Southeast

Activities in the electrical field in the Southeast continue quiet, though there is an increase in the number of inquiries and orders from industrial firms. Central-station companies are marking time and placing only a reasonable volume of orders. The largest central-station order reported last week was for high-tension line - construction materials amounting to about $8,000. Other line-construction material orders included one for wire and cable totaling $2,274 and creosoted pine poles amounting to $2,100. House-type meters continued in reasonably steady demand, one company ordering $1,000 worth of this metering equipment last week. Another power company order called for switching equipment totaling $1,500. A textile electrification project in Georgia was reflected last week in orders for motors amounting to $4,700, wiring materials costing $4,100 and three 250-kva. transformers. Another textile mill in that state ordered $3,000 worth of inside wiring materials. A brick plant in the same state ordered one 333-kva. transformer and contemplates the immediate purchase of three 100-kva. transformers. The latter equipment may be ordered during the coming week. Purchases by contractors are generally small, though the larger contractors are buying a little better than the smaller. One contractor ordered this week $1,500 worth of conduit in one order.

Construction projects are as follows: The United Public Service Company, Chicago, plans extensions and improvements in the ice-manufacturing plants at Mobile, Ala., to cost about $100,000. The River Falls Power Company, River Falls, Ala., contemplates the construction of a power plant at River Falls, Ala., to cost about $150,000. The Southeast Georgia Power Company, Alma, Ga., will make extensions and improvements in its local power plant. Kingan & Company, Indianapolis, plan a cold storage and refrigerating plant on Peters Street, Atlanta, to cost about $100,000. The Mississippi Power & Light Company, Pine Bluff, Ark., plans a transmission line to Hazelhurst, Miss., and vicinity. The Tennessee Electric Power Company, Chattanooga, Tenn., plans an expansion and improvement program in 1928, to cost about $5,000,000, including power-plant and transmission-line extensions. Clarksville, Tenn., is considering an ornamental lighting system in the business district. The Union Carbide & Carbon Corporation, New York, plans an expansion program at plants in vicinity of South Charleston, W. Va., to cost about $4,000,000.

Motor Sales Are a Factor on Pacific Coast

The week, according to one California manufacturer, has been distinguished by its orders for small motors, such as a $10,000 assortment of motors and parts for an oil-burner company, 275 1/20-hp. motors, valued at $3,500, for calculating machines, and 100 ¼-hp. motors and washing machines. The outstanding order of the week covered a 500-kw. rotary converter complete with transformer switchboard and accessories, total value $45,000, for a chemical company. Other wattmeter orders include 250 of residence type, value $3,000, for stock and installation in the Bay region and 220 watt-hour meters, also ten assorted transformers, sizes 15 kva. and 25 kva., for the Hawaiian Islands. The city of Seattle opened bids on valves and gates for the Diablo Dam, the low bidders being: Hendy, $12,798 for three butterfly valves, size 78 in.; Pelton, $24,980 for a 72-in. Johnson valve; Phillips & Davies, $120,000 for six caterpillar gates. The El Camino Irrigation District of Tehama County is requesting bids for six deep-well pumping plants complete. Alameda County has purchased $70,000 worth of Sturtevant ventilating equipment and motors, costing $14,000, for the Oakland estuary tube.

Sales of motors and heavier apparatus made last week in Seattle include about $135,000 for a 72-in. Johnson valve and for three caterpillar gates, one 8 ft x 10 ft. and two 15 ft. x 20 ft., for the Diablo Dam of the Skagit project of the city of Seattle; two switchboards, costing $15,000 each, for pulp and paper mills for the Zellerbach interests at Port Townsend and Hoquiam; 25 motors, from 50 hp. down, supplementing a former order for a hemlock mill in Tacoma; a 200-hp. motor and 10-in. pump to a sand and gravel company, and about 75 motors from 50 hp. down by several jobbers to dealers and to lumber mills for replacements. Pole-line distributors report one or more inquiries of consequence from a central-station company for poles and equipment for proposed transmission line, stating that sales are very light with indications for improvement fair. The city of Seattle within sixty days will buy about $20,000 worth of distributing transformers of from 250 kw. and down and $20,000 worth of weatherproof wire for local distribution.

Construction projects are as follows: The Texas-Louisiana Power Company, Fort Worth, plans a power plant and an ice plant at Duncan, Ariz., to cost about $125,000. Alhambra, Calif., is asking bids until Feb. 6 for the installation of an ornamental lighting system on a number of streets. Los Angeles has authorized an ornamental lighting system on Hillcrest Road, using pressed-steel standards. Los Banos, Calif., has plans maturing for an ornamental lighting system in the business district. Madera, Calif., has authorized an ornamental lighting system on F Street. Monrovia, Calif., has authorized an ornamental lighting system on a number of streets, using concrete standards. Riverside, Calif., has authorized an ornamental lighting system on Palm Avenue, Del Ray Court and other thoroughfares. Torrance, Calif., is completing plans for an ornamental lighting system on a number of streets in the business district. The Santa Ana County Supervisors have authorized plans for an improved lighting system on highways near Westminster, Calif., to cost $21,000. Caldwell, Idaho, plans an ornamental lighting system in the business district. Butte, Mont., is considering an ornamental lighting system on East Park Street. The Great Northern Utilities Company, Shelby, Mont., is considering an ice plant, to cost about $70,000. Albuquerque, N. M., has plans for an ornamental lighting system on South Second Street and West Copper Avenue. The Cascade Power Company, Brevard, N. C., has applied for permission for a hydro-electric power development on the Wenatchee River, near Wenatchee, Wash., to cost about $350,000. The Priest Rapids Ice & Cold Storage Company, White Bluff, Wash., plans a cold-storage and refrigerating plant.

Middle West Reports Excellent Business

Good business has continued in the Middle West section this week. Its volume is appreciably large for the first part of the year, and indications are that it will continue. Industrial activity is noticeably good, building activity is getting under way nicely, and the railroads are coming into the market for equipment. Utility companies are figuring on large quantities of cable, and considerable purchasing of apparatus is going on, the sales including nine 20,000-kva. oil-insulated self-, water- and forced-oil-cooled, single-phase, 60-cycle power transformers; fifteen 2,222-kva. regulating transformers, one 150-kv. neutral kenotron cable-testing set, smoke uptakes and air ducts for three boilers complete with appurtenances, and meter-control equipment for three boilers complete with appurtenances. Cable manufacturers report an increase in the number of inquiries received, and pole-

line hardware manufacturers are busy. Prices remain generally firm. Owing to a price war on lock nuts, bushings and outlet boxes, the established prices were cut considerably.

Current construction includes the following: Elgin, Ill., plans an ornamental lighting system on North Street, from Spring to Douglas Avenues. The Interstate Public Service Company, Goshen, Ind., has purchased the Midway Electric Company, Shipshewana, Ind., and plans extensions in transmission lines in that district. The Iowa Railway & Light Corporation, Cedar Rapids, Iowa, will build a transmission line from Gilbert to Story City, Iowa. Fordson, Mich., plans a municipal power plant. The Michigan Electric Power Company, Bad Axe, Mich., is arranging an expansion and improvement program in the "Thumb" district, to cost about $500,000, including transmission-line extensions. The Neligh Electric Light Company, Neligh, Neb., has approved plans for the construction of a power plant on Main Street, to cost $100,000. The Montana-Dakota Power Company, Minneapolis, is negotiating for the purchase of the distributing system at Williston, N. D., and plans extensions in the transmission lines. The Northern Ohio Produce Company, Cleveland, plans an ice and cold-storage plant on Woodland Avenue, to cost about $3,000,000. Elyria, Ohio, will build a power plant in connection with the proposed sewage-disposal system, to cost about $850,000. North Milwaukee, Wis., plans an ornamental lighting system on Villard Avenue. Stoughton, Wis., plans extensions and improvements in the municipal power plant. The National Ice & Coal Company, West Allis, Wis., has superstructure under way for an ice plant to cost in excess of $60,000.

Activities of the Trade

Changes in Allis-Chalmers Manufacturing Company

The Allis-Chalmers Manufacturing Company, Milwaukee, has opened a new district sales office at Phoenix, Ariz., covering Arizona, New Mexico and the northern part of Mexico. The office is at 308 Heard Building, with J. B. Cooper as manager. Mr. Cooper's headquarters were formerly in Los Angeles. A branch of the district office at Dallas has been opened at San Antonio, 619 Frost National Bank Building, with Earle R. Hury in charge. A branch of the Detroit district office is being opened at Grand Rapids, Mich., in the Weiss Service Building, with G. C. Culver in charge.

Cutler-Hammer Company Opens Pacific Coast Offices

Since Jan. 1, 1928, the Pacific Coast offices of the Cutler-Hammer Manufacturing Company, Milwaukee, manufacturer of electric motor-control apparatus and allied lines, have been handled by its own sales organization at 970 Folsom Street, San Francisco; 229 Boyd Street, Los Angeles, and 2203 First Avenue, South, Seattle. The new sales district will be in charge of Fred H. Oberschmidt, a member of the Cutler-Hammer organization for more than fifteen years. Associated with Mr. Oberschmidt at the San Francisco headquarters office will be A. A. Tuffert and George P. Stone. Thomas N. Bristow will be in charge of the Seattle office and Edward G. Nelson of the Los Angeles office.

Complete stocks of standard items in the Cutler-Hammer line will be carried at all Pacific Coast offices. The company states that special arrangements have been completed whereby production and shipment of special equipment for the Coast, built in the Cutler-Hammer factories at Milwaukee and New York, will be given preferred attention. This is the second new sales district to be opened by the company within a short period. An office at Atlanta was recently established.

National Carbon Company, Opens Branch Offices

The carbon sales division of the National Carbon Company, Inc., with general sales headquarters at Cleveland, has announced the opening on Jan. 3, 1928, of branch sales offices at the present brush service plants of the company in New York City, Chicago, Pittsburgh and Birmingham. The addresses of the newly established offices are as follows: 357 West Thirty-sixth Street, New York; 551 West Monroe Street, Chicago; Arrott Power Building, Barker Place, Pittsburgh, and 1824 Ninth Avenue, North, Birmingham. Complete sales and service organizations have been established at each office, and the customers of the company have been requested to address all orders and inquiries for carbon brushes and the other carbon specialties to the nearest branch sales office.

E. A. Williford, manager of the carbon sales division at Cleveland, announces the following appointments: J. A. Hammond, assistant manager in charge of carbon brush and specialty sales (Mr. Hammond will be at the headquarters office at Cleveland); E. R. Geib, assistant manager in charge of sales of illuminating carbons (Mr. Geib also will be at the headquarters in Cleveland); E. C. Friday, district manager in charge of the branch office at New York City; J. L. Green, district manager in charge of the branch office at Chicago; V. J. Nolan, district manager in charge of the branch office at Pittsburgh, and J. B. Collins, sales engineer in charge of the branch office at Birmingham.

THE GOLD SEAL ELECTRIC COMPANY, 250 Park Avenue, New York City, manufacturer of radio tubes, announces that it has taken over the business of the Gold Seal Electric Company of Cleveland, manufacturer of household electrical appliances. The company states that factories will be maintained in Cleveland, Ohio, and Newark, N. J., with executive sales offices at New York City.

THE CHAS. L. WARD COMPANY, manufacturers' agent, 701 Midland Building, 1229 Baltimore Avenue, Kansas City, Mo., has added Western red cedar poles to its line, and has concluded an arrangement with B. J. Carney & Company, Minneapolis, to cover the states of Missouri, Kansas, Nebraska, Oklahoma, Arkansas and Texas.

THE ROLLWAY BEARING COMPANY, INC., Syracuse, N. Y., announces the opening of a Pittsburgh sales office at 614 Empire Building, Pittsburgh, in charge of Samuel Farrell, who for a number of years was in charge of the Youngstown (Ohio) office of the company.

THE EDISON ELECTRIC APPLIANCE COMPANY, INC., 5600 West Taylor Street, Chicago, has recently added to its line of "Hotpoint" ranges the RA77 de luxe automatic electric range, the R102 and the R103 apartment-house models and the H52 kitchen heater furnished as an attachment to the R73, R74 and R77 ranges.

THE GRAYBAR ELECTRIC COMPANY, Graybar Building, New York City, announces the following changes in its organization: J. F. Davis was appointed manager at Boston; A. R. Loughborough, manager at Pittsburgh; H. W. Dye, service and credit manager at Denver, replacing J. Hageman, who has been transferred to St. Louis; Louis Fiille has been elected secretary, and Martin Wagner, assistant secretary.

THE RAILWAY & INDUSTRIAL ENGINEERING COMPANY, Greensburg, Pa., announces that E. L. Flowers, formerly in the New York office, has been transferred to the Boston office as district manager, superseding Patrick O'Moore, who has resigned.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson, Md., manufacturer of portable electric tools, has acquired the Van Dorn Electric Tool Company, of Cleveland, Ohio.

JOHN G. OLIVER, formerly connected with the Greensboro district of the Georgia Power Company, has been transferred to Gainesville in the same capacity.

New Equipment Available

Switch House Designed for Maximum Accessibility

A sheet-steel weatherproof switch house equipped with roof bushings for direct connection to disconnecting switches and overhead bus structures, with space for different-sized circuit breakers, potential transformers and secondary control and metering equipment, has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston. No twists are necessary in the connections within the house or in those leaving it. All apparatus is easily accessible. Circuit-breaker tanks are readily removed through the rear doors. The front and rear of the control and metering panel are conveniently reached, facilitating the testing of connections, meters and relays. All auxiliary wiring is in conduit and test terminals are provided.

Automatic reclosing service can be furnished with either alternating-current or direct-current supply, the service being of one or more closing cycles with constant or varying time delay. Protruding channel-iron sills drilled for anchor bolts facilitate lifting and handling. The switch house is constructed of sheet-steel plates electrically welded, and the roof overlaps the four walls, affording a weatherproof construction.

Single-Operator Welder

A single-operator welder rated at 300 amp., one hour, 50 deg. C. temperature rise, is announced by the General Electric Company as the latest addition to its standard line of welding equipment. This machine includes a four-bearing, ball-bearing motor-generator set with flexible coupling. With this equipment the manufacturers claim a rapid and simple interchange of motors may be made by the user. The generator is so designed that field control is unnecessary and is eliminated. The generator panel includes an ammeter and a voltmeter which have a metal front except for the glass over the scale, thus minimizing the possibility of breakage.

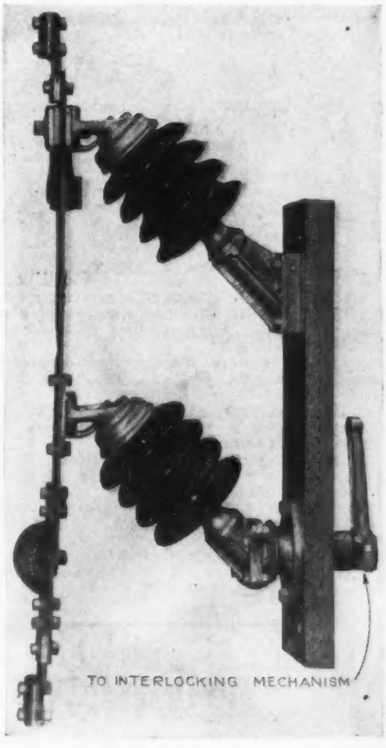
Belt, motor or engine drive may be used with the generator, which is designed for either stationary or portable use. The unit can be used as both a manufacturing and a repair tool.

General-Purpose Motor

A starterless general-purpose squirrel-cage motor has been placed on the market by the Star Electric Motor Company, Newark, N. J. The new motor is said to be similar in every way to the standard single squirrel-cage general-purpose motor and retains all of the desirable features of that type. The unit is made in sizes up to 30 hp., and has synchronous speeds of 900, 1,200 and 1,800 r.p.m. for general industrial application. The starting current inrush is said to be within the National Electric Light Association requirements, without impairment of efficiency and power factor. Like all Star motors, this line is equipped with large ball bearings which offer long-life characteristics with low frictional losses.

Outdoor Gang-Operated Disconnecting Switch

A gang-operated outdoor disconnecting switch, which is particularly applicable for installations where extra insulation is required, such as in substations located near the seacoast where salt air and fog tend to reduce the insulator flashover, has been developed by the Delta-Star Electric Company, Chicago. The switch illustrated is equipped with fog-type insulators having a very large leakage surface. The insulator units are of the same height and interchange with the standard petticoat "unit-type" insulators used for equipment of the same voltage rating.



GANG-OPERATED OUTDOOR DISCONNECTING SWITCH WITH FOG-TYPE INSULATOR

This switch is of the side-break type, requires but two insulators per pole and is furnished with double self-aligning full-floating contacts. The base dimensions are the same as the base dimensions of single pole-hook-stick-operated switches, thus making the change to this gang-operated switch a simple matter.

Network Protector

The type CM-2 network protector, placed on the market by the Westinghouse Electric & Manufacturing Company, is said by the company to represent in several respects, a radical departure from existing standards in design and arrangement of network protector equipment.

The CM-2 protector includes, as standard equipment, a three-element polyphase relay, a single-phase phasing relay, a silver-faced contactor-type main circuit breaker isolated by liberal barriers, and an operating mechanism, which may be either motor- or solenoid-closing and can be equipped with either a 24-volt shunt trip or a 20 per cent drop-out undervoltage release trip. All control wiring and relays are mounted on a separate-hinged steel panel which may be swung out to give free access to the main panel. All control wiring is held in place by cleats on the back of the relay panel, thus making it simple to trace out circuits. The relays are mechanically held in place on the steel panel by the same screws that make the electrical connections to them. Any internal relay circuit may, therefore, be tested by removing the proper screws. The new scheme of control wiring in conjunction with the three-element high-torque polyphase relay and the phasing relay have provided positive assurance against any type of pumping, regardless of system conditions or primary voltage now known. The control circuits may be "killed" without disturbing the main unit by opening a two-pole knife switch and removing two-clip-type fuses which have been provided for protection of this equipment.

The new protectors are available in 800-amp. and 1,200-amp. sizes, both subway and open type, and later a 2,000-amp. protector also will be marketed. No major changes have been made in the 250-amp. and 500-amp. units, except the addition of the polyphase and phasing relays and the disconnecting features which permit isolating the unit from the system. In general, the basi features claimed by the company for the design of the new type CM-2 protector are improved operating characteristics, a minimum number of parts, accessibility, ease of maintenance, compactness, light weight and fool-proof operation.

SMALL TURBO-GENERATOR UNIT.—A direct-connected turbo-generator unit having a rating of 3 kw. has been recently placed on the market by the Westinghouse Electric & Manufacturing Company. This apparatus has been developed to meet the demand for a high-grade small non-condensing steam-turbo-generator lighting set for use with oil-well rigs, steam shovels, isolated pumping plants and for general outdoor construction work. The generator coils are specially impregnated, and all parts requiring such protection are heavily sherardized to meet conditions of applications such as marine service.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 24, 1927)

1,653,947. ELECTRICALLY CONTROLLED INDICATING INSTRUMENT; H. L. Decker, Toledo, O. App. filed Aug. 23, 1926.

1,653,951. HIGH-FREQUENCY COIL; E. B. Featherstone, Toledo, O. App. filed Nov. 13, 1922.

1,653,961. ELECTRICITY METER; F. Holden, Hampstead, London, England. App. filed April 22, 1926. In which a conducting bell or armature rotates in a body of mercury while being acted upon by a magnetic field.

1,653,999. BATTERY CONNECTION; W. E. Goodwin, Cedar Bluff, Va. App. filed Sept. 21, 1926.

1,654,038. LINING FOR DRY CELLS; C. P. Feibel, Lakewood, O. App. filed Dec. 15, 1924.

1,654,046. PROCESS FOR THE PRODUCTION OF ARC LIGHT ELECTRODES; L. Kahl, Berlin-Dahlem, Germany. App. filed May 31, 1923.

1,654,047. STRAIN INSULATOR; J. S. Lapp, Le Roy, N. Y. App. filed May 10, 1922.

1,654,085. VOLTAGE LIMITING DEVICE; G. T. Lorance, New York, N. Y. App. filed Oct. 21, 1925. For limiting the voltage applied to a specific part of a transmission system.

1,654,097. ALTERNATING CURRENT SUPPLY MEANS; W. J. Shackelton, Scotch Plains, N. J. App. filed Oct. 8, 1923. To reduce fluctuations in the voltage across the terminals of the secondary winding of a transformer when a variable voltage is impressed upon the primary winding.

1,654,139. OPEN ELECTRIC FURNACE; P. L. J. Miguet, St.-Julien-De-Maurienne, France. App. filed Sept. 29, 1926.

1,654,143. ELECTRIC TERMINAL; T. C. Russell, Chicago, Ill. App. filed July 23, 1926. Adaptable in electrical heating devices, such as flatirons.

1,654,150. ILLUMINATING APPLIANCE; W. W. Thompson, Dorchester, Mass. App. filed July 16, 1923. For use in the sick room of a hospital.

1,654,162. LIGHTING FIXTURE; L. C. Doane, Meriden, Conn. App. filed Sept. 17, 1924.

1,654,177. SELF-CENTERING CORE FOR DRY BATTERIES; H. M. Koretzky, Hoboken, N. J. App. filed Dec. 31, 1924.

1,654,212. INSULATOR FOR HIGH TENSION ELECTRIC CURRENT; W. Deutsch, Frankfort-on-the-Main, Germany. App. filed Feb. 4, 1924.

1,654,227. DRY CELL; H. Vignon, Paris, France. App. filed Nov. 4, 1925.

1,654,254. CONNECTER FOR ELECTRICAL CONDUCTORS; W. F. Hendry, Ossining, N. Y. App. filed Jan. 7, 1924. For use with push-button switches or the like and as a connecting clip or binding post.

1,654,273. ELECTRIC HAIR DRIER; W. G. Shelton, New York, N. Y. App. filed Oct. 4, 1924.

1,654,282. SYSTEM OF CONTROL; R. E. de Camp, Wilkinsburg, Pa. App. filed Nov. 20, 1919. For controlling the sequence of operation of a plurality of electromagnetic switches for controlling the operating circuits of dynamo-electric machines.

1,654,292. ELECTRIC HEATING UNIT; A. D. Keene, Pittsburgh, and K. Ehrgott, East Pittsburgh, Pa. App. filed Feb. 10, 1925, for electric ranges.

1,654,302. CONTROL APPARATUS; H. R. Meyer, Wilkinsburg, Pa. App. filed July 15, 1920. For electric railway vehicles.

1,654,303. AUTOMATIC TRANSFORMER SWITCHING SYSTEM; C. McL. Moss, Pittsburgh, Pa. App. filed March 23, 1922.

1,654,305. VENTILATION OF DYNAMO ELECTRIC MACHINES; S. G. Nottage, Murraysville, Pa. App. filed Aug. 6, 1925.

1,654,306. LAMINATED CORE; P. Paszkowski, Irvington, N. J. App. filed Jan. 22, 1925.

1,654,308. ELECTRICAL MEASURING INSTRUMENT; R. T. Pierce, East Pittsburgh, Pa. App. filed May 12, 1923. Alternating-current ammeter or voltmeter mechanism.

1,654,309. CIRCUIT INTERRUPTER; K. C. Randall, Edgewood Park, Pa. App. filed April 18, 1922. Governed by conditions in the circuit which it is desired to control.

1,654,315. QUICK-ACTING THERMAL RELAY; R. J. Wensley, Edgewood, Pa. App. filed April 6, 1923.

1,654,316. CIRCUIT INTERRUPTER SYSTEM; W. R. Wickerham, Pittsburgh, Pa. App. filed Oct. 5, 1923. For use on systems of electrical distribution adapted to supply energy from a common distributing circuit to a plurality of feeder circuits.

1,654,317. VOLTAGE BALANCING REGULATOR; J. H. Ashbaugh, Pittsburgh, Pa. App. filed Jan. 2, 1926.

1,654,338. SUPPORTING MEANS FOR ELECTRICAL CONDUCTORS; A. M. MacFarland, Wilkinsburg, Pa. App. filed Dec. 29, 1923. Embodied in resistance units and electric heaters.

1,654,350. BLOCK LETTER SIGN; W. G. Shelton, New York, N. Y. App. filed Nov. 7, 1924.

1,654,360. REGULATOR SYSTEM; J. H. Ashbaugh, Wilkinsburg, Pa. App. filed Oct. 4, 1924. Incorporating a short-circuit protective device.

1,654,373. ELECTRICAL SWITCH MECHANISM; F. A. Holt, Elmhurst, N. Y. App. filed June 2, 1923. For use as a circuit controller in flashlights or the like.

1,654,382. METALLIC ARC-WELDING APPARATUS; F. C. Owen, Fayetteville, N. C. App. filed Feb. 12, 1925.

1,654,394. LIQUID RHEOSTAT; C. C. Whittaker and D. C. West, Pittsburgh, Pa. App. filed Nov. 5, 1923.

1,654,419. ELECTRIC FURNACE; A. E. Greene, Medina, Wash. App. filed Nov. 23, 1922.

1,654,467. EXPLOSIVE BLOW-OUT SWITCH; J. P. Medlin, Great Falls, Mont. App. filed Nov. 25, 1925.

1,654,475. CONNECTER DEVICE; C. W. Wyman, Claremont, N. H. App. filed April 8, 1922. For use in coal mining for the purpose of making running and fixed contact with the trolley wires employed in the entries of such mines.

1,654,483. CIRCUIT CONTROLLER; J. M. Johnson, Kansas City, Mo. App. filed Oct. 17, 1921.

1,654,505. AUTOMATIC STATION; S. G. Leonard, Lakewood, O. App. filed Dec. 29, 1925.

1,654,508. FLEXIBLE CABLE; C. R. Boggs, Waban, Mass. App. filed Feb. 11, 1926.

1,654,511. ELECTRICAL INTERLOCKING MECHANISM; D. L. Galusha, Bronxville, N. Y. App. filed April 3, 1924.

1,654,518. CENTRIFUGAL MECHANISM FOR ELECTRIC SWITCHES AND OTHER APPARATUS; L. S. Walle, Scotia, N. Y. App. filed June 8, 1922.

(Issued Jan. 3, 1928)

1,654,521. SAFETY TOGGLE-BREAK SWITCH; E. E. Anderson, Chicago, Ill. App. filed Jan. 12, 1925. High-tension switch with a distant control.

1,654,523. REFRIGERATOR CONTROL MECHANISM; W. E. Bihl, Chicago, Ill. App. filed June 8, 1923.

1,654,534. ELECTRICAL INSULATOR; E. A. Dean, Oak Park, Ill. App. filed Sept. 28, 1923. High voltage.

1,654,546. ELECTRIC CABLE; F. S. Malm, Chicago, Ill. App. filed April 6, 1923. Submarine cable.

1,654,551. FLUID-HEATING DEVICE; K. Muhleisen, Philadelphia, Pa. App. filed Dec. 20, 1924.

1,654,562. ELECTRIC FLASH WELDING OR HEATING MACHINE; A. C. Taylor, Warren, Ohio. App. filed Oct. 3, 1923.

New Trade Literature

POWER FOR IRRIGATION.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a special publication No. 1786, entitled "The Modern Power for Irrigation," which gives information necessary to estimate and install electrically driven pumps in any conditions encountered in irrigation projects, as well as the various phase of irrigation.

SWITCHING AND PROTECTIVE EQUIPMENT.—Bulletins GEA-570A, GEA-572, GEA-545B, GEA-841 and GEA-880 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its hand-starting compensators for squirrel-cage induction motors, automatic switching equipment for synchronous converters in mining service, automatic supervisory, selector-type equipment for control and indication of remote power apparatus, its CR7006-D 26 magnetic switch and CR4409 protective panels for providing overload and undervoltage protection for direct-current crane motors.

MOTORS AND GENERATORS.—Bulletins GEA-61A, GEA-63A, GEA-529A, GEA-858 and GEA-873 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate type CD constant-speed direct-current motors from 3 hp. to 200 hp., type GTE motors for gearless-traction elevators, low-speed synchronous motors for direct connection to reciprocating compressors, low-speed direct-current commutating pole generators for direct connection to steam or internal-combustion engines and the improved brush holders for GE-70 and GE-80 railway motors.

BAFFLE WALL.—The Boiler Engineering Company, 931 Federal Trust Building, Newark, N. J., has issued a bulletin describing the "Beco" baffle wall. Drawings as well as photographs of typical installations are included.

LIGHTING UNITS, TRAFFIC SIGNALS AND AIRPORT LIGHTS.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-373A, GEA-313A, GEA-740A, GEA-742A and GEA-906, covering the "Novalux" ornamental units, forms 8 and 9; "Novalux" electric traffic signals, "Novalux" traffic signal control apparatus, and airport boundary lights, respectively.

STEELPLATE BLOWER.—Bulletin No. 3504 issued by the American Blower Corporation, Detroit, describes and illustrates the type SE steelplate blower. This bulletin supersedes bulletin No. 2004.

GROUND-RESISTANCE TESTER.—Bulletin No. 1165 issued by James G. Biddle, 1211 Arch Street, Philadelphia, covers the "megger" ground-resistance tester for testing the resistance to earth of all types of ground connections. A diagram of connections is included, and complete directions for the operation of the instrument are given.

CUT-OUTS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-732A, describing and illustrating the "D & W" oil-fuse cut-outs, type D.

SCREWS, BOLTS, RIVETS AND NUTS.—A catalog issued by the Pheoll Manufacturing Company, 5700 Roosevelt Road, Chicago, describes and illustrates its screws, bolts, rivets and nuts. This catalog contains reference tables, including the "American Standard Screw Threads" and the recently adopted standard dimensions and tolerances for screws, bolts, rivets and nuts.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase or agency is desired in Cairo, Egypt (No. 29,004), for electrical appliances, bells, switches, sockets, and general supplies.

An agency is desired in Cairo, Egypt (No. 29,005), for electrical appliances, plain and colored insulated wire, switches, sockets, shades, etc.

An agency is desired in Berlin, Germany (No. 29,006), for electrochemical specialties.

Purchase and agency are desired in Milan, Italy (No. 29,003), for electric hair-cutting machines.

An agency is desired in Auckland, New Zealand (No. 29,008), for electric household appliances.

An agency is desired in Hamburg, Germany (No. 29,079), for electric household appliances.

Purchase and agency are desired in Hanover, Germany (No. 29,002), for message-transmitting devices for hotels and electric laboratory stoves.

An agency is desired in Quebec, Canada (No. 29,001), for small electric household refrigerators.

An agency is desired in Milan, Italy (No. 29,044), for trolley wire.

Direktionsrat Deck, Elektrizitaetswerke in Wien, Mariannengasse 4, Vienne 1X, is desirous of obtaining catalogs of various electrical household appliances including electric cooking devices.

The city of Riga, Latvia, plans a new power plant about the latter part of 1929 at Kremershof across the river Duna from Riga.

The city of Sherbrooke, Quebec, Canada, will construct a dam and a power house at Westbury, Quebec.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Possibilities of Increase in Residential Energy Sales

ANALYSIS of operating statistics for 1926 of 70 systems in various parts of the United States, all but a few of them having more than 30,000 residential customers, shows a range of nearly six to one in the average annual energy consumption per residential customer. The smallest is 231 kw.-hr., the largest is 1,290. Regional averages fall between 335 and 455 kw.-hr. per residential customer, with the exception of the Mountain states, where the unusually high consumption reported by one large company materially raises the average. The weighted average for all the companies is about 400 kw.-hr. The national average for the entire electric light and power industry, taking into account the numerous small properties, is probably somewhat lower and seems to justify the generalization that the average residential customer in the United States takes about 1 kw.-hr. a day.

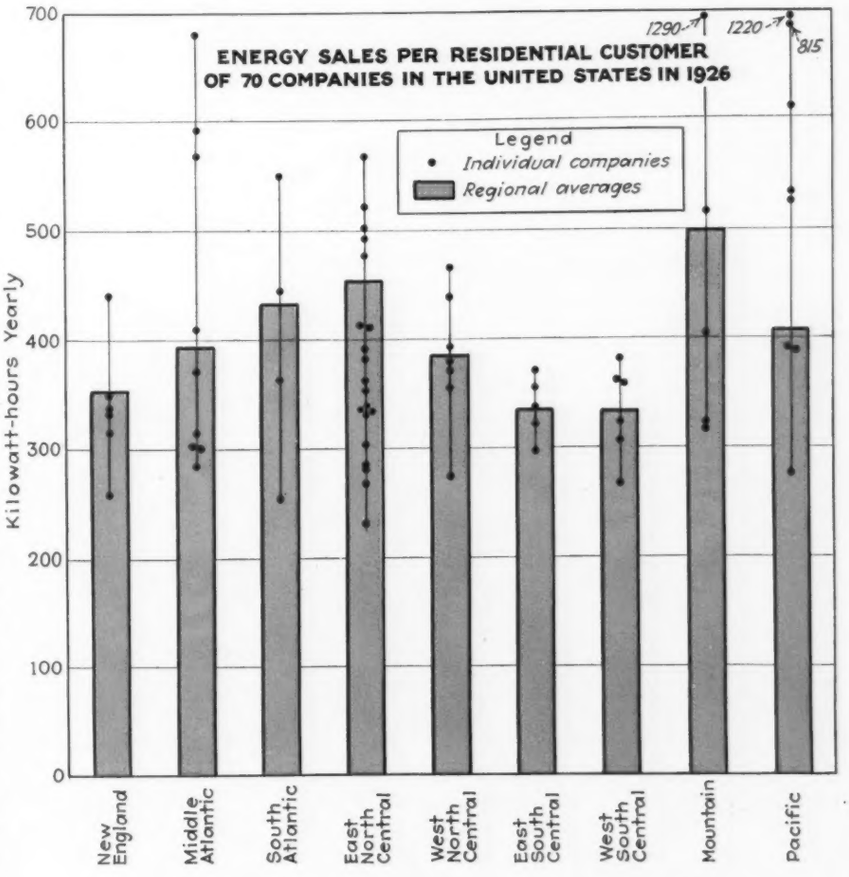
The highest sales per customer are in the West. Low long-hour rates possible with water power, combined with other favorable local conditions, probably go far to account for that condition. If small operations could be included the showing might not be so good

The comparison between companies suggested by such a chart as the one here presented is not entirely fair. Its chief weakness lies in the lack of a universally accepted and accurate definition of "customer" or "consumer," hence the figures reported under this heading by different companies do not necessarily all mean the same thing. For that reason companies have not been designated. But in a national sense it makes little difference if some of the points are moved up or down, even so much as 5 per cent. The variation in the basis on which the returns may be made can scarcely amount to more than that. Another small change would be made by using the average number of customers rather than the number at the end of the year, if the former had been available.

The high results attained by some companies cannot be expected in all cases. Conditions differ. But as growth by the acquisition of new customers proceeds more and more slowly, greater attention is necessary to the problem of increasing consumption by those already on the lines. The advantages of electric service are well known; there is no lack of desire on the part of the public to avail itself of them. Long-hour use of electricity is of advantage to both buyer and seller.

But where this is not recognized and encouraged, the consumer is virtually subjected to a handicap against using those load builders that are competitive with non-electrical devices. If greater residential energy consumption is desired, and that generally means a more liberal use of oil-burners, ranges, refrigerators, and other off-peak devices, it must be conscientiously fostered by salesmanship and, in particular, by suitable rate structures.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.



Company averages of sales range from 231 to 1,290 kw.-hr. per year

1927 Industrial Operations in the Middle Atlantic States Were 0.7 Per Cent Under 1926

REPORTS on the consumption of electrical energy by the manufacturing plants operating in the Middle Atlantic States indicate that the rate of productive operations in 1927 as a whole was about 0.7 per cent under those witnessed during 1926. During the first quarter of 1927 industrial operations were continually under the same period of 1926, but during the remainder of the year operations have been at times slightly over those reported for the same months in 1926. In general the year closed with the rate of productive operations slightly over those at the close of 1926.

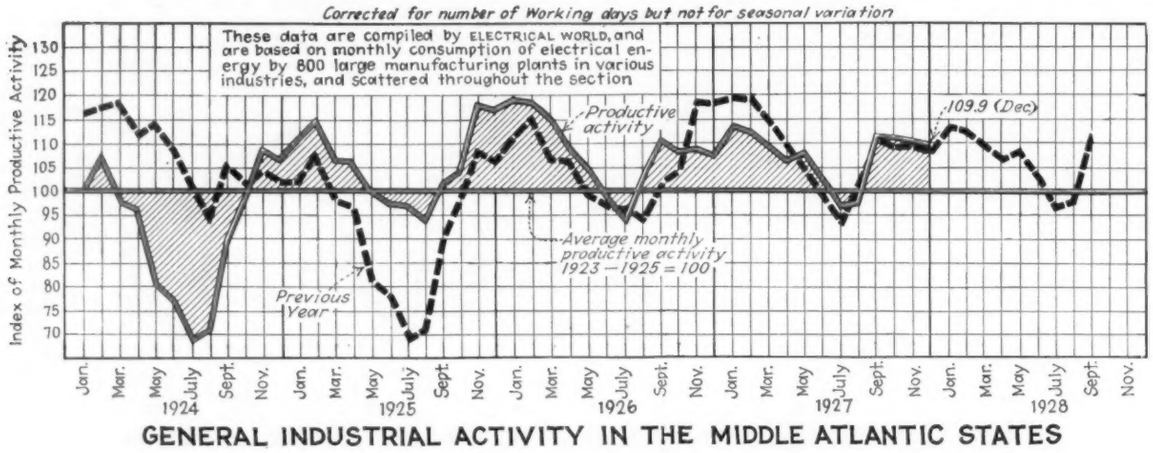
The leather and its products industry was the only primary industrial group in the Middle Atlantic States to report December operations over those of the previous November. The rolling mills and steel plants were operating at a rate 4.5 per cent under November. and the operations in the ferrous and non-ferrous working plants during December were 5.5 per cent under November. The textile industry reported December productive activities 7.6 per cent over December, 1926.

Indexes of Productive Activity in the Middle Atlantic States

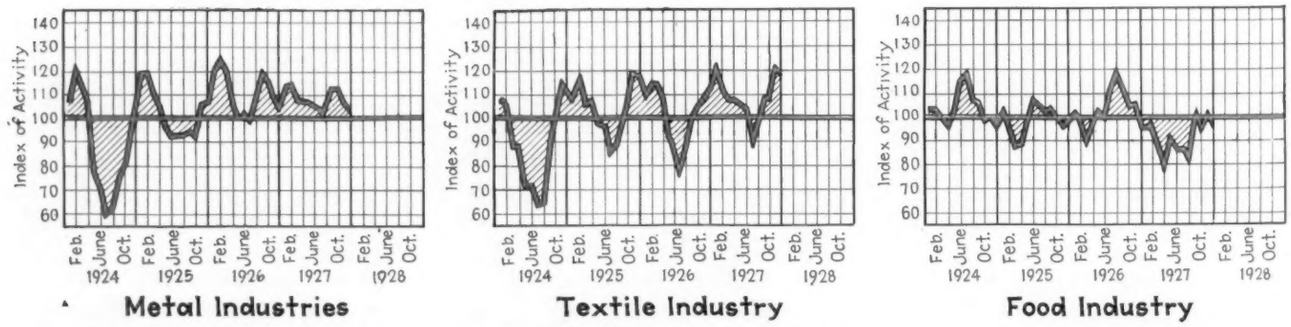
All Figures Adjusted for Number of Working Days

	Dec., 1927	Nov., 1927	Dec., 1926	Average for Full Year, 1927	Average for Full Year, 1926
All industries	109.9	110.4	107.3	107.5	108.4
Automobile, including parts and equipment	104.0	109.7	52.1	101.5	114.7
Chemical and allied products	107.3	114.3	106.2	108.4	114.3
Food and kindred products	97.0	101.0	.....	.....	.....
Leather and its products	115.0	113.5	123.4	101.9	98.7
Lumber and its products	104.5	117.2	.....	.....	.....
Ferrous and non-ferrous metal working plants	101.5	107.7	.....	.....	.....
Rolling mills and steel plants	101.4	106.3	104.8	105.6	111.3
Paper and pulp	123.5	127.0	125.4	122.6	117.3
Stone, clay and glass	97.6	106.7	.....	.....	.....
Textiles	120.0	121.2	111.5	108.4	102.2

ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*


Corrected for number of Working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 800 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
109.9 (Dec)
Average monthly productive activity 1923—1925 = 100
Previous Year
States in MIDDLE ATLANTIC GROUP
New York
Pennsylvania
New Jersey
1924
1925
1926
1927
1928

GENERAL INDUSTRIAL ACTIVITY IN THE MIDDLE ATLANTIC STATES



PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE MIDDLE ATLANTIC STATES